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PIPE LINE INDUSTRY

OCTOBER
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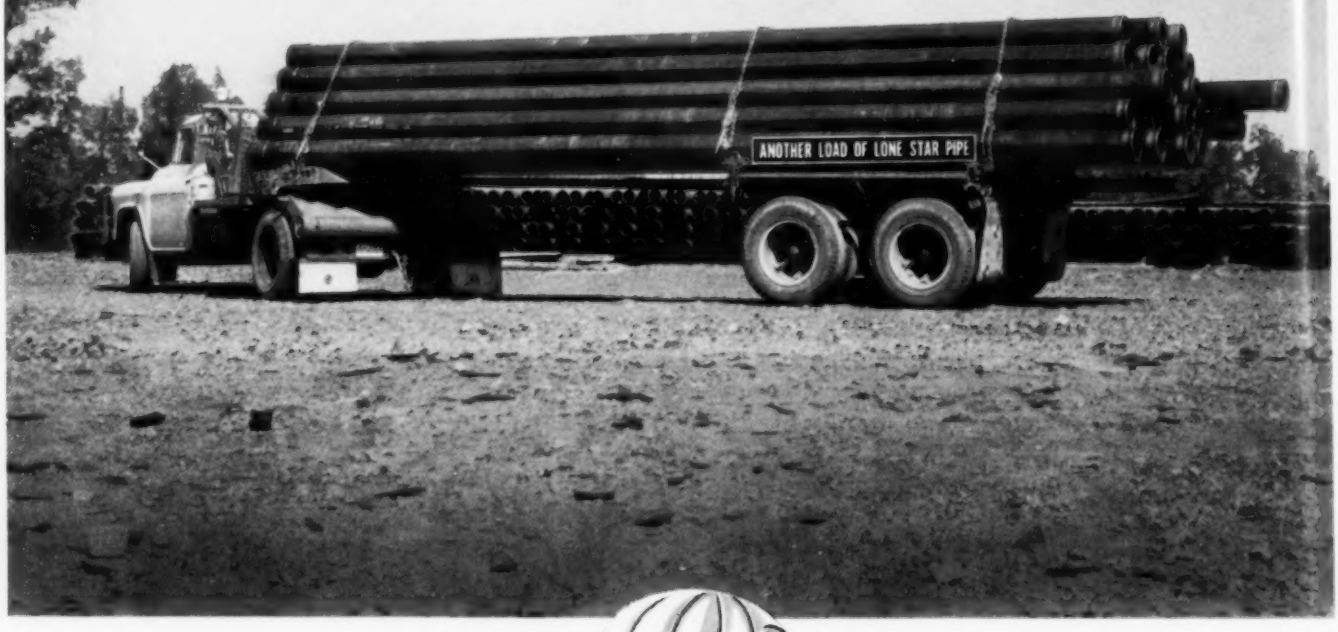

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OCT 13 1960

PIPE LINE INDUSTRY

A GULF PUBLISHING COMPANY PUBLICATION

October 1960 Vol. 13, No. 4

CONTENTS and Quick Look

To help you put first things first, scan these time-saving digests, checking ✓ those you want to read first.

Using Jacket Water to Drive Cooling Fans

☐ This is the most inexpensive means of cooling the water and it requires no auxiliary power source. Jacket water from the engine is piped through volute pumps which serve as water turbines to drive the cooling fans. The efficiency of the drive is rated at about 80 plus percent. There are many advantages to this installation.
By F. Zapffe.....Page 16

Caisson Makes Underwater Repairs Look Routine

☐ Repairing an offshore pipe line in 24 hours, Interstate Oil Pipe Line Company made it look routine with its newly developed caisson. To operate, simply lower caisson over pipe, clamp it securely, pump out water and send welder down the hole to make repairs. Caisson saves time, money and eliminates possible danger of bending pipe by lifting it out of water.....Page 21

Analyzing Single Phasing of Three-Phase Motors

☐ Pipe lines are one of the biggest users of electric motors in the world. For this reason pipeliners give much thought to their operations. For example, what happens when one of the lines bringing three-phase supply to a motor accidentally opens? Will the single phase burn the motor up? Must it be shut down? The answer to these and other problems for pipeliners makes interesting, thought-provoking reading.
By R. C. Moore.....Page 23

Speak Up When Disaster Strikes

☐ In times of crisis, your organization's entire reputation is at stake, yet in spite of this, some companies fail miserably. Here's how an enlightened management can keep a plant disaster from becoming a public relations disaster. You'll want to clip this article and keep it on hand.
By Henry H. Hunter.....Page 29

How Asphalt Coatings Are Holding Up in the Ditch

☐ When one coating manufacturer instituted annual inspections for the pipe line companies that bought its coatings, it opened the way to increased knowledge of in-the-ditch performance of coatings. Ultimately this series of tests will enable pipeliners to accurately evaluate coatings before they are installed. The annual tests primarily center around current requirements.
By Pearce Butterfield.....Page 33

Injecting Volatiles Into Crude Lines Automatically

☐ This newly developed instrument set-up can control the vapor pressure of blended crude and products to a fraction of a pound. This prevents slugs of high-vapor pressure products which can disrupt pipe line operations.
By P. R. Scott.....Page 35

Sample Bombs Can Be Bombs

☐ Here is a case history of how and why a container filled with a sample of field butane ruptured in the laboratory of Indiana Standard's Mandan, N. D., refinery. After reading this you may want to review your own procedures and equipment for sampling light hydrocarbon mixtures.....Page 41

How to Get Along In Latin America

☐ With the increasing significance Latin America is playing in the world today, it is becoming more and more important for you and your organization to strive for good public relations when you are there. Here are a few tips which will enable you to interpret Latin America with a Latin view.
By Thomas Garcia-Borras.....Page 46

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So . . . for whom should you vote?

On November 8 you may step into a booth, completely alone, and make the most important decision of your life. Certainly it will be the most important one of the next four years for Americans and perhaps for free people everywhere. It is a paradox that while voting is a great privilege and a serious responsibility no one can make you vote. Nor, thank God, can anyone tell you how.

Unless you are blind, deaf, or a hermit you will hardly be able to escape statements of the aims of candidates and political parties in the coming five weeks. You may even have the opportunity to meet one or more of the leading candidates face to face. Surely, never before have two major party leaders been so eagerly seeking your audience. If only through a "glass ended box".

The heralded TV debates between Nixon and Kennedy scheduled to cover domestic issues on September 26, a general news panel session on October 13, foreign policy on October 21, plus possibly an extra on October 8 should enable virtually all voters to know where the candidates "stand". If you have a TV set, can get into a hotel lobby, or even a bar you can get a better insight of the candidates' plans; though your logic may be clouded somewhat if you have to settle for the latter locale.

If you're a reader who still has the July issue of Pipe Line Industry, we suggest you review again "Why the Pipe Line Industry Should Take an Active Part in 1960 Political Campaigns" starting on PAGE 32. Although this was compiled by Associate Editor Don Lambert before either of the conventions, we believe it still presents accurately the positions of both candidates, Nixon and Kennedy, on oil and gas issues that will be vital to the pipe line industry.

While you have that issue in hand glance over again the comments of Former Texas Governor Allan Shivers on "practical politics" in the PAGE 4 editorial. If political affairs are ever to be carried out on a reasonable, businesslike basis it will take action by informed and dedicated businessmen at work in every area where they can work effectively. Governor Shivers' thoughts are worth reading and following through again.

It is important that you make a serious effort to know the facts about what the candidates reasonably can be expected to do on all issues both international and national. Many of us are of the "old school"; we would like to be living in the comparatively carefree days before World War II. Communism then was not a serious (we thought) threat to freedom. There were no atomic and hydrogen bombs to worry about. No ICBMs, missile carrying submarines nor cruisers to deliver hell to our homes in minutes. No potential aggressor 90 miles away from our country, but today foreign relations questions are just as vital to the happiness and security of every American as are all of the domestic ones.

So your choice in the sanctity of the booth will have to consider the intelligence, judgement, character and initiative of the leader who will have to make many grave decisions on these matters. And though the next President will have many advisers, the responsibility will be his alone. To predict how either Kennedy or Nixon will react in such situations we suggest you read all you can on the personal background of each of them; and you can do it with 35 cent outlays for paperbacks.

The choice is yours. There are hundreds of millions in the world who do not have that privilege. For that reason alone, your vote should be precious. It has been paid for and rebought with the lives of millions of men and women. So misuse of your right might well be considered treasonable though no man but you would know it. Many will vote for a candidate for wrong and unworthy reasons; some selfish, some foolish, and perhaps some ridiculously humorous. But we hope you won't. Learn the facts, listen to the candidates, study the issues and then go vote as if it were the last time you were ever going to have the right.

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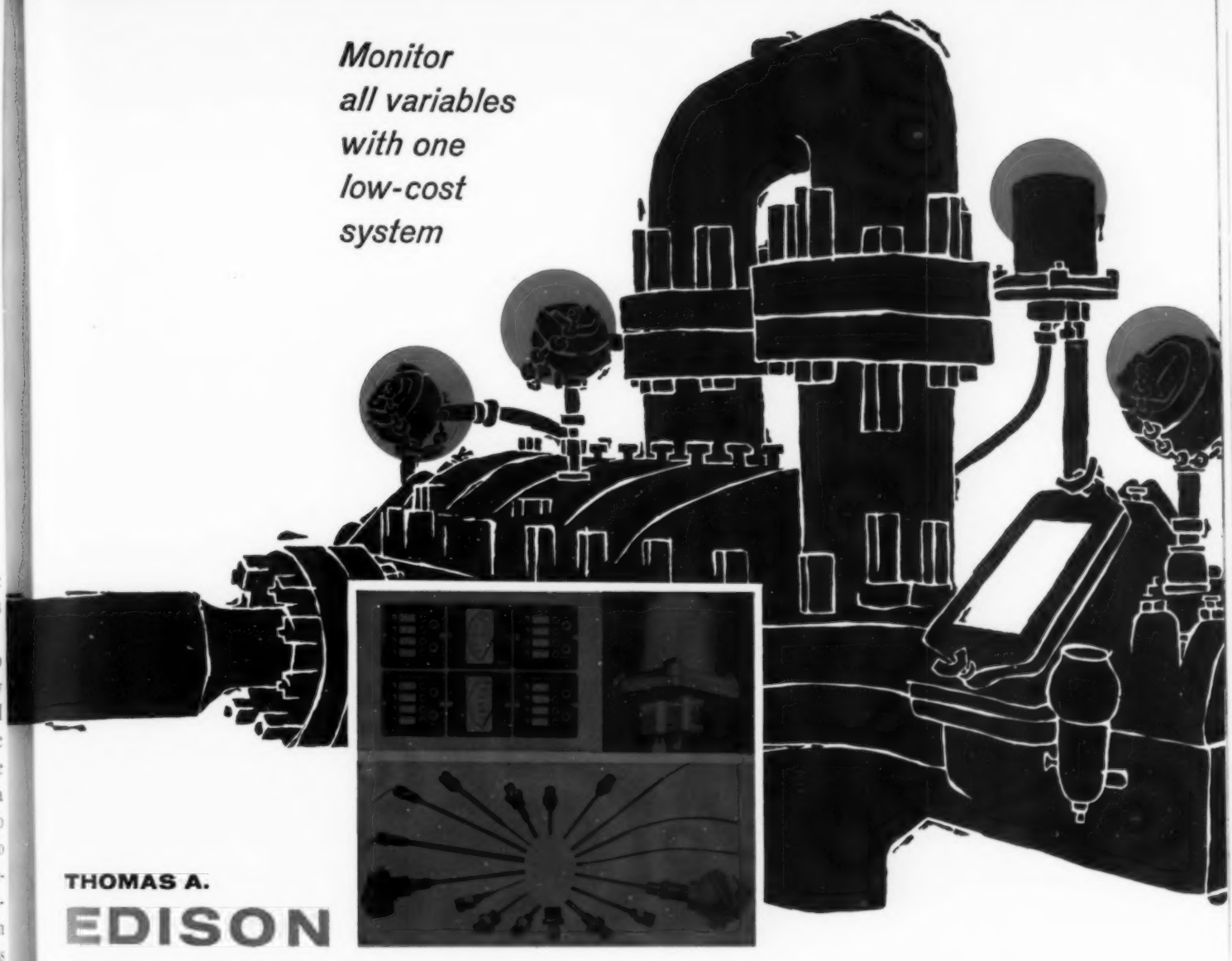

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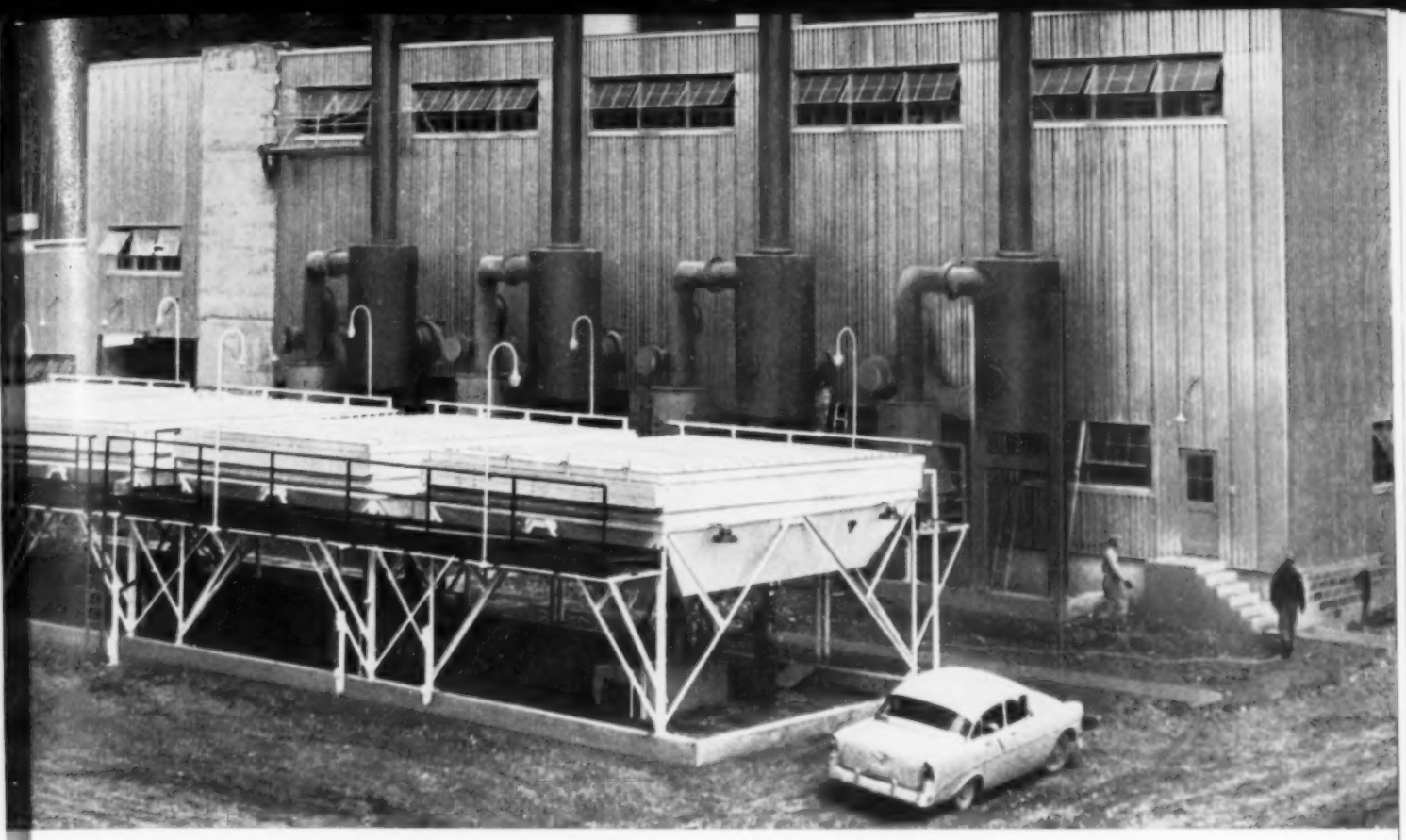

Twenty air cooled units like this cool engine jacket water for four Canadian "Big Inch" compressor stations. Units are designed to dissipate 8.6 MBTU/hr. from the 288 gpm jacket cooling water at temperatures from 170 to 110° with an ambient temperature of 90° F. General contractor: Canadian Bechtel, Ltd.

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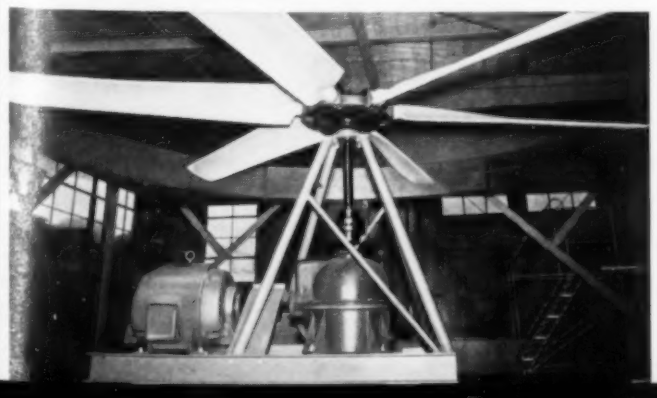

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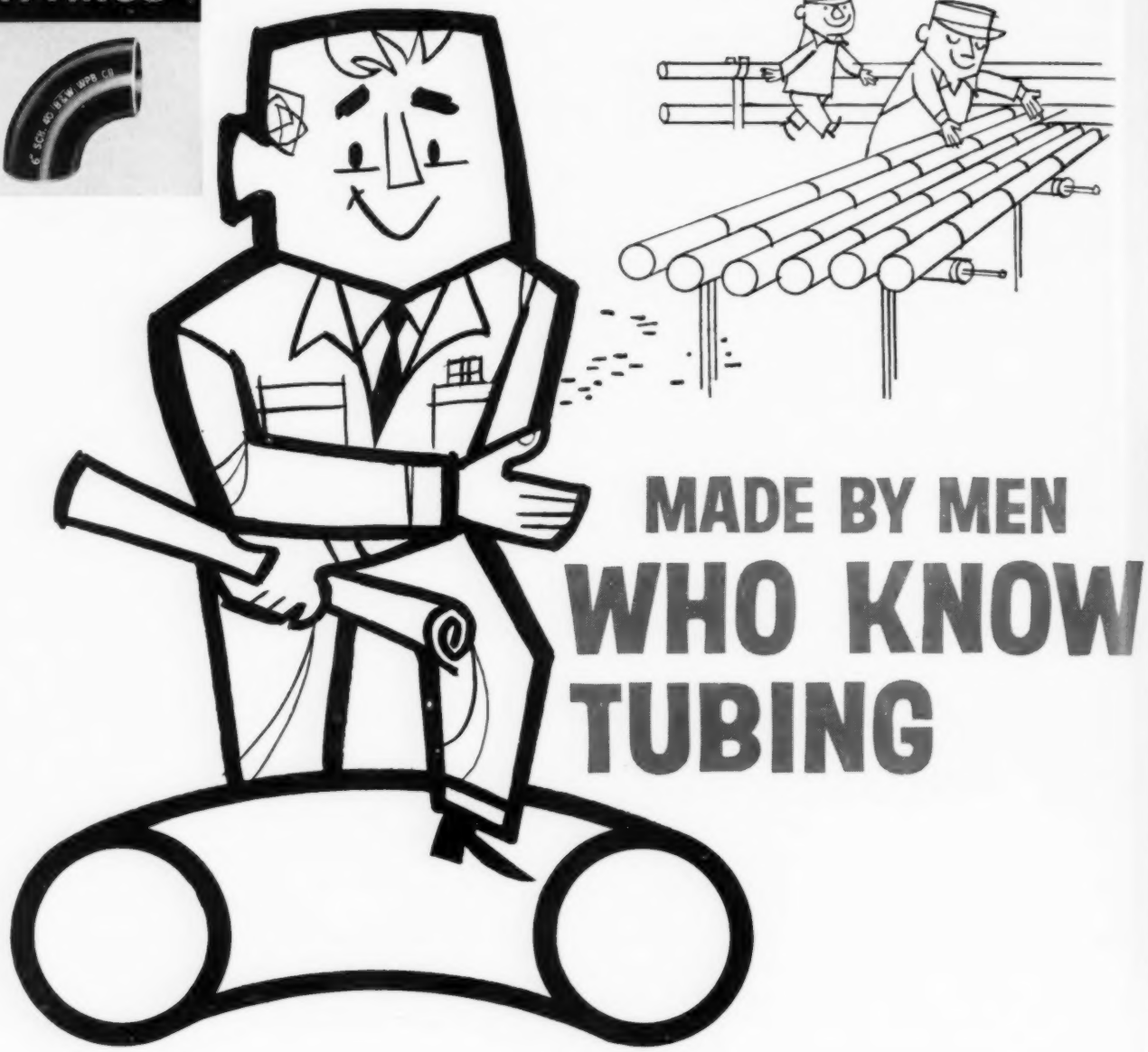

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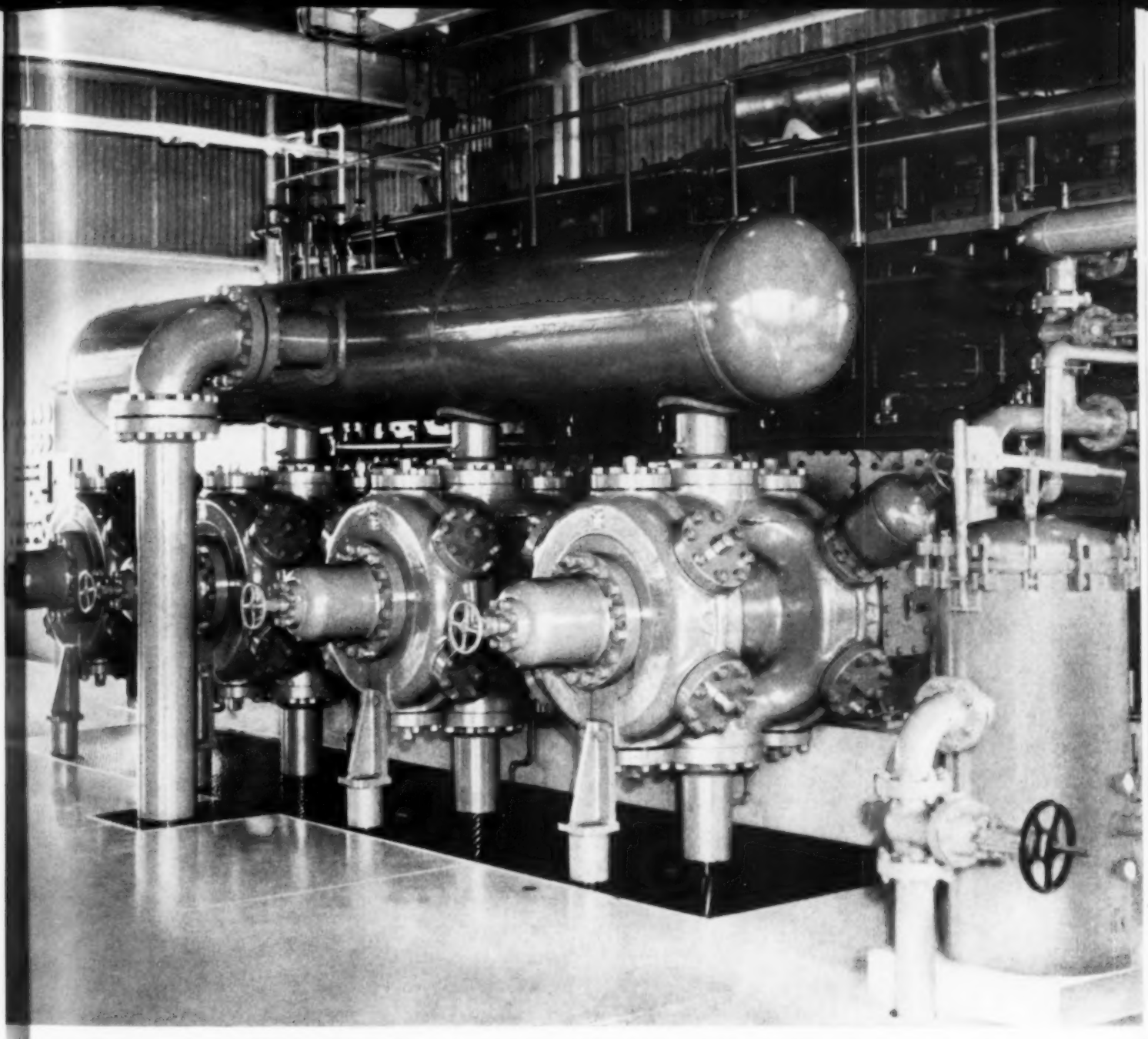

At Northern Natural's Clifton Station, this SUTC engine compressor operates

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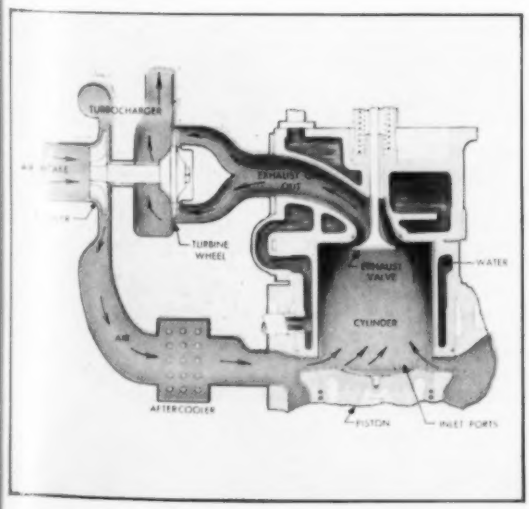

Self-sustained turbocharging at any speed and load is possible because of SUTC's exclusive Uniflo scavenging.

Five years ago a remarkable new engine compressor was introduced.

Called the SUTC, this Worthington turbocharged 2-cycle engine compressor was unlike any other. Combustion air enters thru side inlet ports, *but the exhaust is thru overhead valves.* Valve timing can be arranged to give maximum supercharging effect.

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Now came the real test. More than 130,000 hp were installed. Operators praised the SUTC's exceptionally smooth, quiet operation. Operational records confirm the machines reliability. Unit G-2312 is typical. This 8 cylinder, 2000 hp SUTC engine compressor was installed in 1957 in Northern Natural Gas Company's Clifton, Kansas Station. To date, it has logged over 20,000 hours—an average of more than 20 hours a day for 3 straight years. A sister unit installed last year has equalled this performance.

May we send you complete data on this unique engine compressor? Please write to H. C. Barten, Worthington Corporation, P.O. Box 953, Buffalo 5, N.Y.

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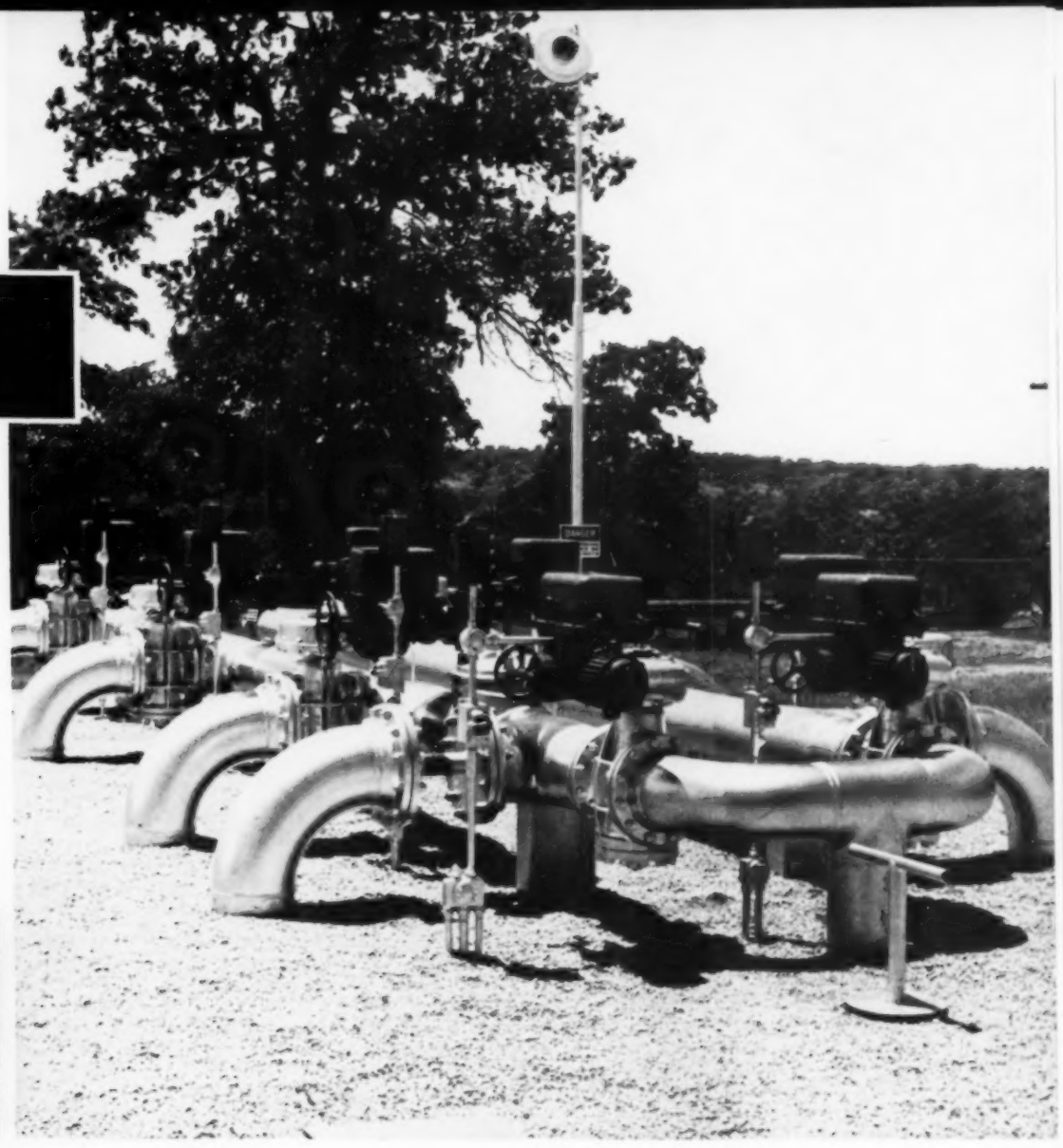

Above, Rockwell-Nordstrom valves doing sentinel duty on the manifold of a terminal at a products pipeline station. Flanges and welding fittings are by Taylor Forge.

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PIPE LINE PANORAMA

Mid-America Line Nears Completion . . . Largest LPG system under construction, Mid-America's 2,100-mile, 6-8-10 inch line, will be supplying Minnesota-Wisconsin markets with products from 39 Texas-New Mexico production sources before year's end. **Real savings are in store for northern purchasers**—products will be shipped through $71 million line 35-50 percent below current rail costs. For more details on design and engineering of this ultra-modern system, be sure to see November PIPE LINE INDUSTRY.

Will California Get South Texas-North Mexico Gas? . . . TGT's recent agreement to supply Southern California Edison with 455 million cubic feet of gas per day between 1962-1982 may be in for stiff opposition.

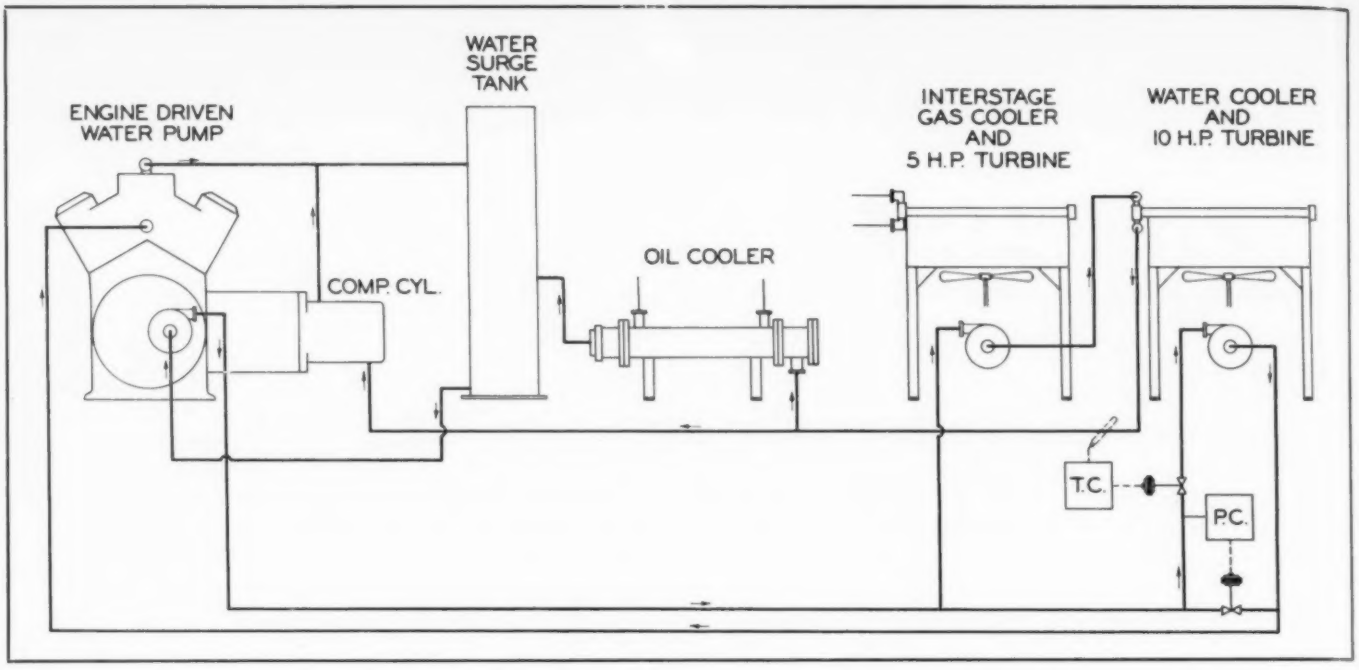
Gas is to be supplied through $225 million project that includes 1,200-mile, $165 million line from Reynosa, Mexico, on Texas border to Mexicali on California border. TGT announces it will build the line, arrange for gas supply and financing, then set up Mexican corporation to maintain and technically supervise it. Mexico's Pemex will own and operate 1,200-mile line, and supply it with Mexican gas.

Meanwhile, Southern California Gas Company and Southern Counties Gas Company say they will vigorously oppose the project. Reason: It would destroy the balance in operations of the certificated gas companies by removing a portion of the load-balancing industrial market.

Pipe Line Briefs . . . FPC's recent decision to increase TGT's rate of return from 6 percent to 6⅛ percent, instead of 7 percent as requested by the company, has stirred the industry to action, i.e., TGT has requested a rehearing, and if this is refused, may contest FPC's split-hearing procedure in Court—Independent Natural Gas Association has filed complaint with FPC concerning too-low rates of return granted to pipe line companies in recent months . . . **Reversing one of its examiners,** FPC has turned down Transco's $52.6 million expansion plan. Reason: Not enough reserves . . . **Interior Department's $255 million, 20-year helium conservation program** (to include construction of 12 extraction plants along natural gas pipe lines) will get underway March 1 with letting of contracts to private companies . . . **Interstate Commerce Commission has given interested parties until October 10** to express views on proposed new rule to consolidate and streamline Commission orders dealing with initial oil pipe line valuations . . . **Look for growing Washington support** for natural gas bill that will free small gas producers (less than 2 billion cubic feet per year) when issue is revived in 1961.

Natural Gas Lines Continue to Set Records . . . FPC reports that during 1960 fiscal year ending June 30, it authorized construction of more than $846 million in new interstate gas transmission facilities, including nearly 9,500 miles of pipe line.

In comparison with this record year, fiscal 1959 approvals totaled $763 million and 4,893 miles of line. Transwestern's $191 million, 1,809-mile line was the largest single approval made during 1960.



SIMPLIFIED SCHEMATIC shows how the jacket water drives the cooling fans at Lone Star's Ambassador Station. The 5-hp and 10-hp water turbines in reality are volute pumps—more or less standard equipment from a manufacturer's shelf. Because of the danger of freezing, the water is mixed with glycol. The author rates four of Lone Star's five water turbine drives above 80 percent.

Use Jacket Water To Drive Cooling Fans

Inexpensive volute pumps used as water turbines are paying off

By F. Zapffe
Lone Star Gas Co., Dallas

WHY NOT USE jacket water to drive the atmospheric cooling section fans? This, in many instances, can be a step toward maximum effectiveness for minimum investment and minimum operational expense in compressor stations. Lone Star Gas Company now has five such installations and all of them are operating satisfactorily.

Background. The first installation of this kind came when the Ambassador Gas Storage Project in Clay County, Texas, was placed in service November 11, 1958. This was the first compressor engine to operate aerial cooler fans driven by the jacket water stream through water turbines.

Two more water turbine installations were completed in June 1959, when a 1,350-hp compressor engine was added to the company's Abilene, Texas, station.

In January 1959 an induced draft cooling tower with a water turbine installed on the fan deck was placed in operation. *This tower is located in an isolated spot distantly removed from electric power.* A gas-engine powered pump at ground level delivers water through the turbine to turn the fan before the water spills through the tower to cool gas from a high temperature distillate field.

With the total accumulation of about six "turbine-years" for the five turbines now in service, Lone Star can report that all units are performing up to all design expectations. Four of the units did develop packing gland nuisance leaks. This problem is correctable by the installation of mechanical seals. Thrust bearings have become overheated and two such bearings have failed. This has been corrected to an acceptable degree and maintenance problems have been reduced to nil.

Lone Star is well satisfied with the turbines and will give them all possible consideration in future applicable situations.

History of this development. Now let us review the development of this efficient, economical water power method of driving auxiliary equipment for a permanently installed compressor engine, it is a logical progression in plant design.

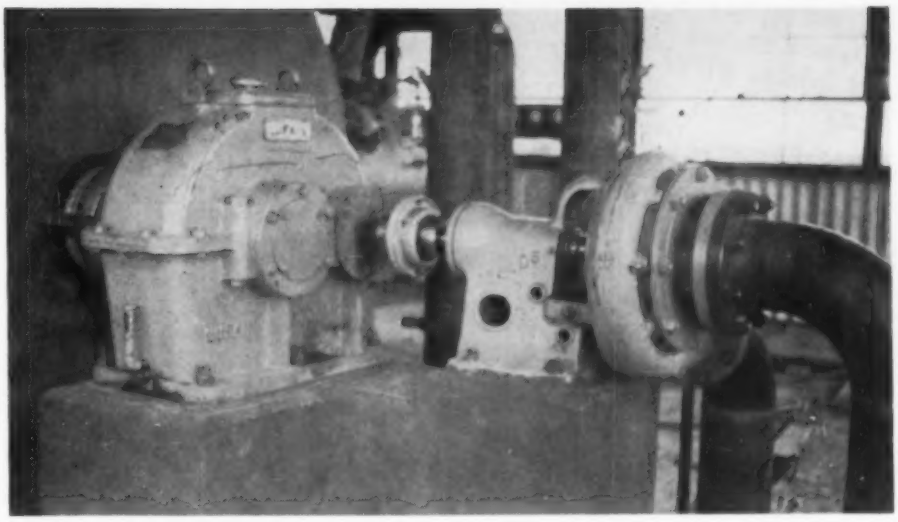
A typical early station would perhaps have a set of station water pumps circulating water through station headers to all engines to cool engine jackets, engine oil and, where required, gas streams. A given pump was belt driven by an individual engine. Then, a pump-engine set was required for standby, because an entire

station could not afford to go down because of the failure of one pump or pump engine.

Electrical power requirements. If the station pumps were motor-driven, an auxiliary generator plant was needed because external power was either expensive or undependable. Then, in addition to having multiple pumps and motors, multiple generators and engine drives were necessary for emergency and maintenance shutdowns. Thus, more than 1.5 kw of electrical generation equipment was required for each installed motor horsepower. The necessary electrical equipment and housing made for rather expensive installation costs per compressor horsepower.

A transition was made to retain the central generation plant, eliminate the station water headers, and have electric driven pumps at each engine to circulate water to the engine jacket and possibly to a shell and tube oil cooler. Aerial coolers with electric motors driving the fans would cool the water and perhaps directly air cool the engine oil. Gas cooling was by direct aerial coolers, eliminating the evaporative cooling tower unless relatively low gas temperatures were required for process purposes.

The next step toward the development of economical compressor station design was in the direction of the hydraulic oil method of driving the aerial fans for water and gas cooling in the so called "modular" method of installation. The "modular" installation makes each compressor and its auxiliary equipment completely self-contained. Each engine is the power source for its own cooling water pump and its own hydraulic oil pump. The oil pump powers the hydraulic motors that turn the engine-water cooler fan and the gas-cooler fan. The only essential connections each engine has with the station are through four headers: suction gas, discharge gas, fuel gas and starting air. The additional advantages of this design over the older stations that have station water pumps and headers are: (1) Because individual gas coolers are provided for each engine, the off-synchronization pulse beat that develops at multi-engine stations is minimized or eliminated, and (2) In the event of the removal of one of the engines for use elsewhere, the electrical and water system of the station is not thrown out of balance and extra pumps and power equipment are not required for the engine moved.

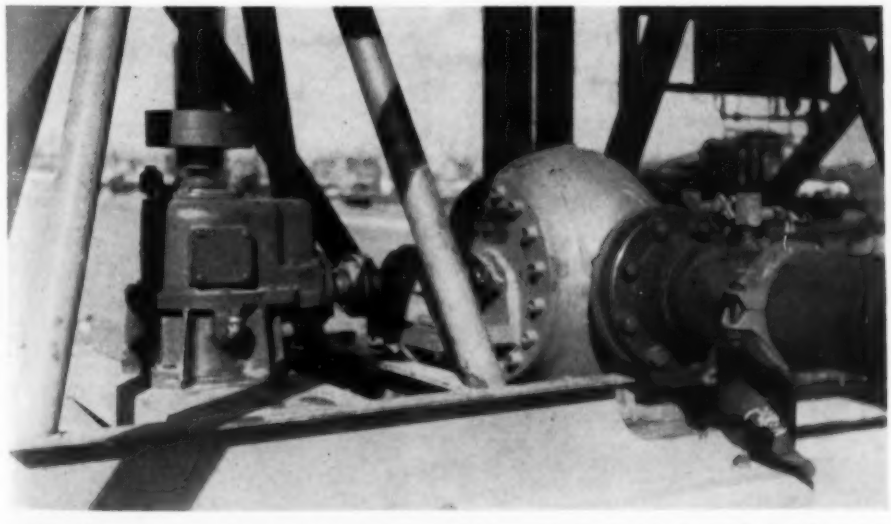


JACKET WATER PUMP at the engine not only circulates water through the cooling system, it drives the cooling fans as shown on the schematic. This is the only source of auxiliary power for moving water and cooling air.

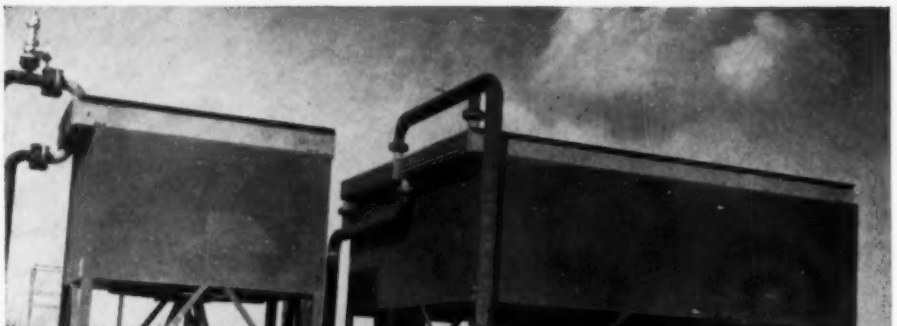
The economy of installation and minimization of maintenance problems of the hydraulic oil power over self-generated electrical power has been established. The hydraulic oil systems will run for long periods without maintenance if properly designed, installed and prepared for operation.

Disadvantages of the Hydraulic Oil Systems. A number of disadvantages inherent in the hydraulic oil system of power transmission weighed heavily in favor of the water power method. Here are some of these factors:

1. Hydraulic oil piping was more-or-less a duplication of the parallel cooling water lines that ran to and from aerial coolers.
2. Mechanical drives from the prime mover to both the water pump and the hydraulic oil pump were intricate and somewhat expensive.
3. The hydraulic oil system required high pressure piping



THE ANGLE GEAR AND DRIVE TURBINE AT COOLING SECTION. The turbine in reality is a volute pump right off the manufacturer's shelf. Advantages of this drive: the pump makes a dependable turbine and it has ample clearance to eliminate need for intensive water straining.



GAS AND WATER COOLERS at the Ambassador Station. Jacket water drives both cooling fans (see schematic). Turbine for gas cooler is 5 hp; for water cooler, 10 hp.

equipment, such as relief valves, strainers, reverse flow check valves, etc.

4. The hydraulic oil system required intensive internal cleaning to eliminate foreign material that could cause lock-up or excessive wear of the close fitting positive displacement oil pumps and motors.

The utilization of the centrifugal water pump as a power source as well as a water circulator was assured when a detailed study developed that the centrifugal water pump, the water turbine and the aerial fan all follow identical laws of speed, head and power. Detailed design was required to equate the efficiency, speed and hydraulic head of the water pump with the similar characteristics of the water turbines to produce the desired horsepower at each fan when the cooling water circuit was balanced to give the necessary cooling water temperatures and volumes.

The resolution of this hydraulic water power-drive for the two cycle 880-hp angle type compressor engine now operating at the Ambassador Station is shown in the simplified schematic of the water system. The unit compresses main line gas at 300 to 800 psig suction pressure through two stages of compression to what will ultimately be the original pressure of the present gas storage field, 2800 psig bottom hole pressure.

How It Works. Now let us follow through the schematic of the Ambassador Station water system as being a typical example of how water turbines can be applied.

The 880 hp engine at full design speed of 300 rpm drives through a gear speed increaser, one centrifugal single stage water pump at 2,100 rpm; it delivers 645 gpm of cooling water at 136 feet discharge head. This pump draws 28.4 hp from the engine to circulate the cooling water and to operate the two aerial fans.

The discharge from this prime mover pump flows to the two water turbines connected in parallel, insofar as the water system is concerned. The turbine driving the interstage gas cooling fan through a right angle gear, requires 240 gpm at 120 feet, differential pressure across the turbine to develop 5 hp at 2,050 rpm. After turning the fan this water is cooled to as low as 125° F., if required, to reject the entire water cooled heat load of the engine—engine jacket water, engine oil and compressor cylinder jacket. Leaving the water cooler, the water stream cools the engine oil in a shell and tube exchanger before returning to the surge-mixing tank. A small side stream cools the compressor cylinders.

The other parallel stream of water from the pump flows to a similar turbine installation that drives the water cooler fan. This turbine requires 405 gpm at 120 feet differential pressure to develop 10 hp at 2,050 rpm. From this turbine the water flows directly to the engine jacket and then to the surge tank to be mixed for suction to the pump.

Controls. The only operational controls required are a six-inch butterfly valve and a two-inch double port valve. The butterfly is pneumatically set by a temperature controller that receives its signal from the aerial water cooler effluent stream. As this valve closes to hold a constant cooled water temperature when ambient temperature drops, the discharge head on the pump tends to increase. This would upset the balance of water flow through the two parallel circuits if the two-inch valve operating as a constant back pressure control valve did not bypass that portion of the 405 gpm not required by the water cooler fan.

The adjustment of the back pressure control valve can be used to effect any reasonable change in differential between the engine jacket water and the engine oil temperatures. While no other control valves are required, several block valves are provided to facilitate maintenance of the various portions of the water system without draining the entire charge of water.

The Ambassador station operation is to be quite variable. The unit will be shutdown in the coldest weather, yet it must remain available upon short notice for operation. Because glycol antifreeze was the only prac-

About the Author

F. Zapffe has headed the design of Lone Star Gas Company's plants since 1952. He has been responsible for the engineering of compressor stations, dehydration plants and assorted special projects. He has been with Lone Star ever since he received his B.S. in chemical engineering from Texas Tech. He has had experience in plant operation in cycling, desulphurization and dehydration plants. He headed the company's central laboratory for three years before moving into plant design.

tical solution to the water freezing problem when the station was shutdown, the volume of the water system was held to a minimum. The surge tank was kept small, with a storage tank provided for maintenance drain down.

The over-all efficiency of this hydraulic water drive system is equal to the efficiency of the better quality hydraulic oil drive systems. In addition, it is much more economical to install and place in operation. The water turbines have the same open clearances that centrifugal water pumps have and do not require that the water piping be cleaned as carefully as in the hydraulic oil system. Maintenance of the turbines will be very similar to that of the centrifugal water pump.

The five units that Lone Star has used thus far range from 5 hp to 32.5 hp. All of them are Francis reaction type turbines. This type unit has fixed vanes or gates to direct the high pressure water effectively into the passages of the runner. The efficiency of four of these five units is 80 to 82 percent. The 5 hp unit runs about 70 percent.

These units were custom made to fit the specific parallel flow requirements of the Ambassador station as well as the similar design at the Abilene compressor station. The unit for the cooling water was matched to the required cooling water volume of 1,800 gpm at 92 feet head to produce 32.5 hp as required by the fan design. Because the heads and volumes had been designed specifically for the given water circuits, extra control valves and devices were not required.

Why are jacket water turbine drives for cooling fans paying off?

1. **The cost is low. The "turbines" are nothing more than volute pumps right off a manufacturer's shelf so-to-speak.**
2. **Efficiency of the drive is in the 80 plus percent range.**
3. **Each engine is driving its own cooling fan.**
4. **The turbine set-up is designed for a particular engine. Few controls are necessary.**
5. **The water turbines have the clearances of the volute pumps (which they are.) No intensive cleaning system is necessary to keep them operating.**

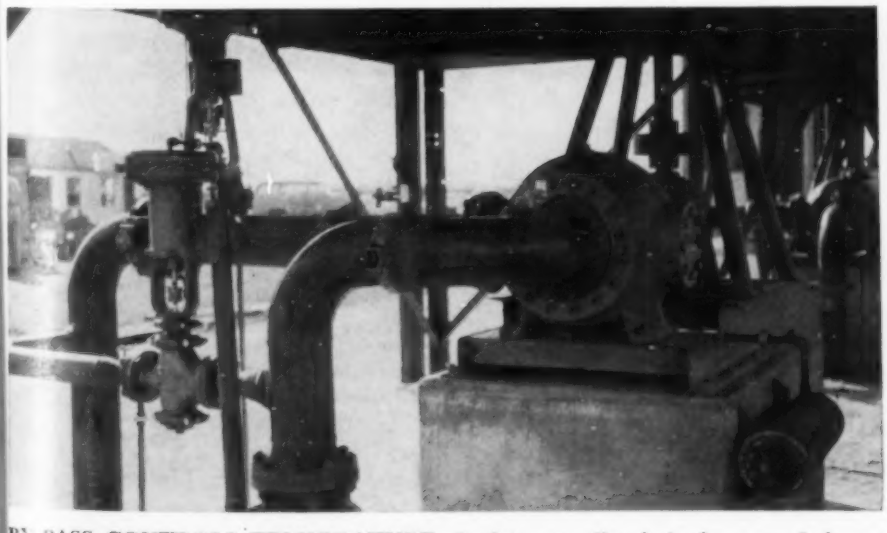
Manufacturers' Developments. In 1954, when the engineering evaluation was started toward the design of a compressor station containing a water powered fan drive, only one pump company could be located which had experience in water drives suitable for this work. This company was ready to talk about water drive units of 35 horsepower and up, but not in the smaller units. Today things are different. Practically every pump manufacturer has small horsepower products for this purpose.

The sizing of these power units is necessarily a detail related to the specific design of each series and size of pump. Each manufacturer will evaluate the desired design specifications for a power unit and possibly fit one of their standard volute pumps to the application, by applying the flow stream into the normal discharge nozzle and tailing out through the suction or eye of the pump. Published pump data need be corrected to some degree before being used to size power applications. Generally, a power unit will be a smaller unit than would be selected for a pump with identical specifications of differential pressure head, volume, rotational speed and horsepower. Properly sized, a volute pump used as a power unit can possibly develop an efficiency as great as when used as a pump.

Following the installation of the Ambassador station, the second compressor station utilizing water driven fans was placed in operation December 15, 1958. This was the Mountain View, Oklahoma, station of the Natural Gas Pipeline Company. The engines in this station are four cycle 3,000 hp units. Each of these self-contained engines employs two water pumps and two volute pumps operating as turbines.

The Texas to Florida line of the Houston Texas Gas and Oil—Coastal Transmission Corporation has every station installed on the main line of the water turbine design. (See PIPE LINE INDUSTRY, May and June 1959.)

More such stations are being installed and others being considered for installation as the full advantages of ease of installation, low investment, reduced operational expense and ease of operational effort are brought to the attention of industry.

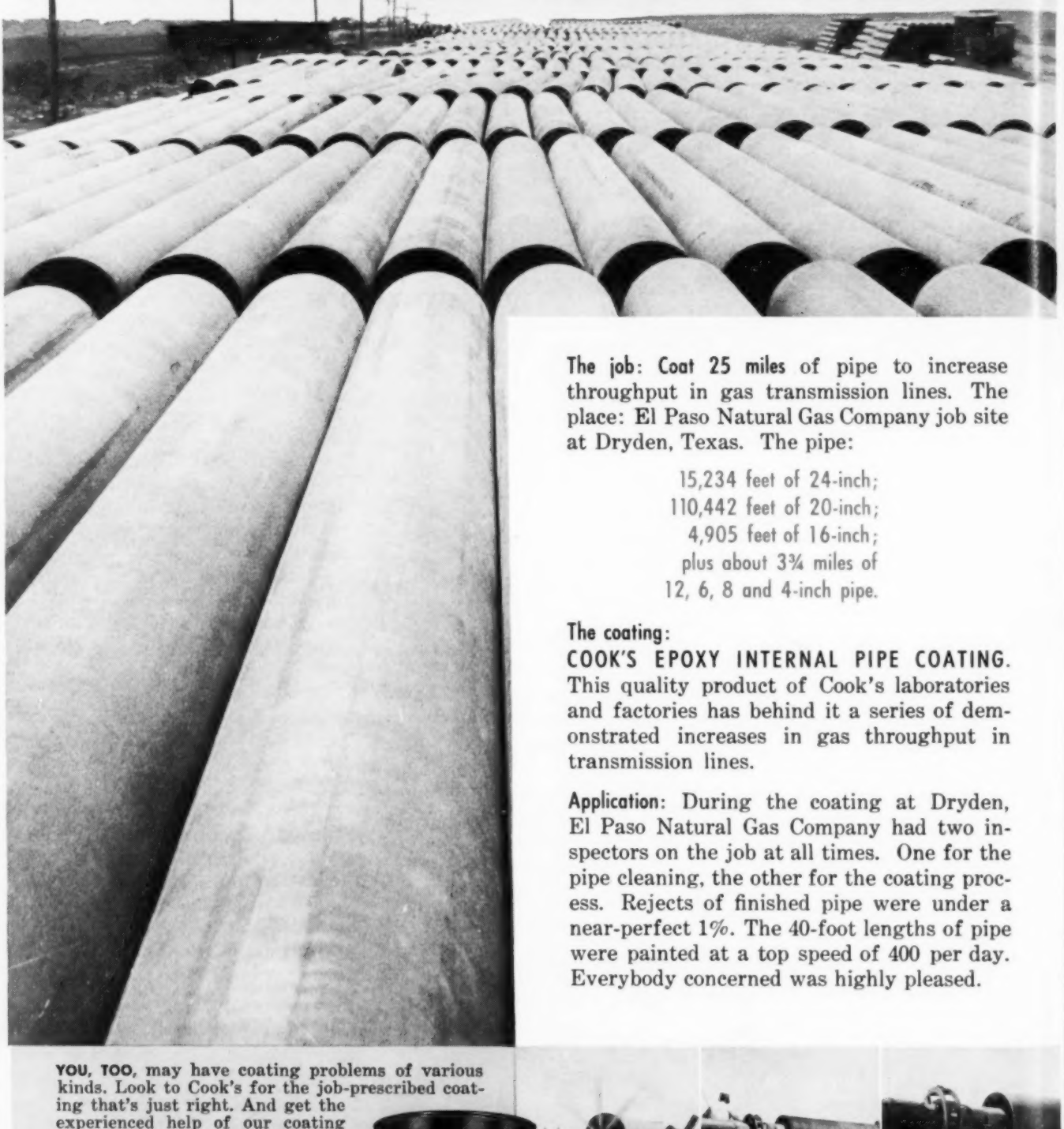


BY-PASS CONTROLS TEMPERATURE. Outlet water line is in foreground; bypass valve to left. Inlet control valve is behind bypass valve.

ACKNOWLEDGMENT

From a paper presented at Seventh Annual Gas Compressor Institute, Liberal, Kans., April 6, 1960.

Why Cook's epoxy internal pipe coating system was selected for another natural gas pipe line...



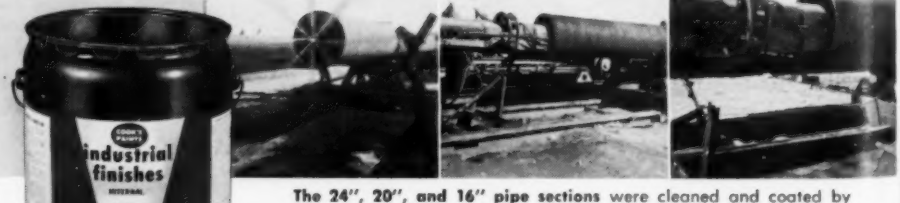
The job: Coat 25 miles of pipe to increase throughput in gas transmission lines. The place: El Paso Natural Gas Company job site at Dryden, Texas. The pipe:

15,234 feet of 24-inch;
110,442 feet of 20-inch;
4,905 feet of 16-inch;
plus about 3¾ miles of
12, 6, 8 and 4-inch pipe.

The coating:
COOK'S EPOXY INTERNAL PIPE COATING. This quality product of Cook's laboratories and factories has behind it a series of demonstrated increases in gas throughput in transmission lines.

Application: During the coating at Dryden, El Paso Natural Gas Company had two inspectors on the job at all times. One for the pipe cleaning, the other for the coating process. Rejects of finished pipe were under a near-perfect 1%. The 40-foot lengths of pipe were painted at a top speed of 400 per day. Everybody concerned was highly pleased.

YOU, TOO, may have coating problems of various kinds. Look to Cook's for the job-prescribed coating that's just right. And get the experienced help of our coating engineers and chemists. They'll analyze your need, provide specific product data sheets and prepare specifications for you or your contractor. Just write, wire or phone.



The 24", 20", and 16" pipe sections were cleaned and coated by the Texas Pipe Coating Co., Inc., of Odessa, Texas, using Crose Perrault machines, shown in action above. Smaller size pipe was done by sandblasting and coating with a 360° spray gun.

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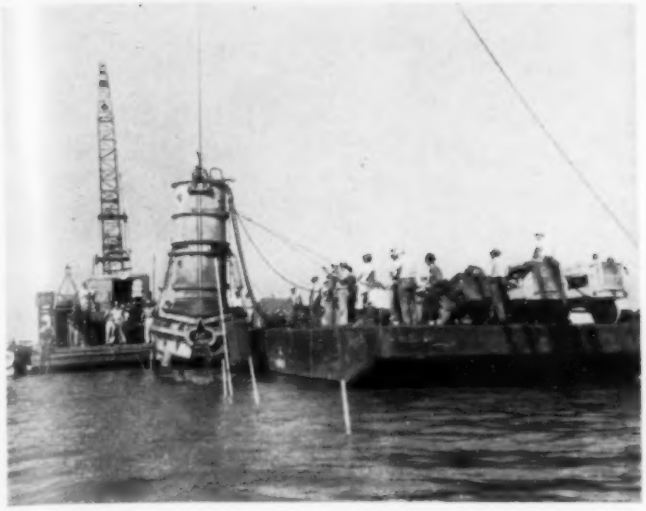


FIGURE 1—Caisson is lowered into water over the 12-inch crude pipe line in Barataria Bay, Louisiana. These photographs were taken during first full test run. Recent repairs were made at night and not photographed.

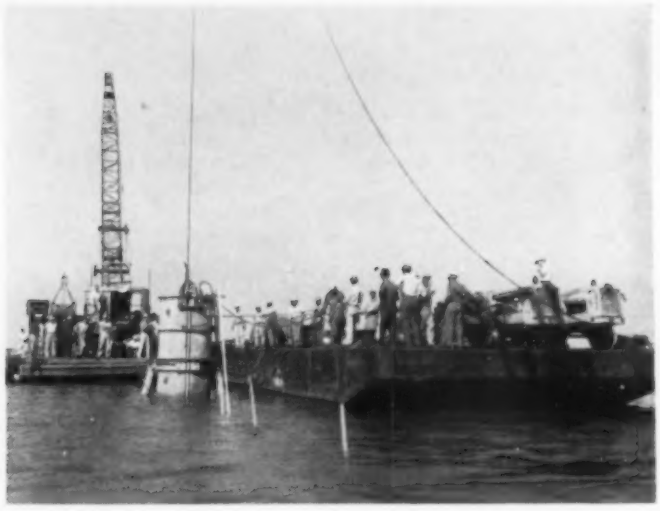


FIGURE 2—Caisson is placed over the pipe and clamped into position. Stakes in foreground helped to guide the repair unit to proper position.

Caisson Makes Underwater Repairs Look Routine

Interstate's new underwater caisson proved successful in making repairs on 12-inch line in 24 hours on first run. Caisson cuts time, costs and eliminates the danger of bending pipe when lifting it above water

A PIPELINER'S NIGHTMARE—repairing an offshore line that has sprung a leak—may soon fall into the category of "routine." In making an advance toward that goal, Interstate Oil Pipe Line Company achieved encouraging results with its underwater caisson repairing a line buried 12 feet below the surface in a 24-hour period.

Interstate's newly developed caisson cut maintenance time to one-fifth of what normal operations would have taken, according to company engineers. The repair was made on Interstate's 12-inch crude line between Lake Washington and Pelican Island in South Louisiana. A small leak, caused by a longitudinal crack of undetermined origin, gave the engineers their first chance to prove out the caisson. It had been tested once in Barataria Bay, but this job was its first really necessary performance.

The leak was spotted by a company patrol plane. Immediately two barges, one with the caisson and the other with a dragline, were dispatched to the vicinity of the leak. In addition to the caisson and dragline, a diver was used to check position of the caisson as it was lowered on to the pipe.

The line was under five feet of water and seven feet of mud. After ditching around the line and jetting the mug plug underneath, the caisson was positioned and lowered on the pipe with the aid of a diver. It was then securely clamped around the pipe, water was pumped out and the working area was ready for workmen to make repairs.

Repairs, which consisted of welding a patch over the small crack in the pipe, were completed during the late evening. The caisson was then removed and the dragline completed backfilling. The entire job took only 24-hours, once barges were on site.

The caisson is a bell-like structure seven feet in diameter, six and a half feet in height, with a vertical split and pipe sleeves midway up the side of the split. On top of the bell-shaped unit is a cylinder five feet in diameter and six feet in height to which are affixed the hydraulic rams for opening and closing jaws of the unit. For this particular job another six-foot cylinder was added making the total height 18½ feet. The additional section was necessary to enable the caisson to extend safely above the water line when clamped on the pipe line 12 feet below.

To clamp the caisson around the pipe, the bell section was opened and closed from controls on the barge. Hydraulic rams, powered by pumps on the barge, opened the caisson before it was submerged. The pipe wells, which circumscribe the pipe line, are designed to be adaptable to pipe sizes up to 20 inches and offer a positive water seal.

To secure watertight work area in the caisson, it was designed with a

FIGURE 3—Water pump is tested after caisson is partially lowered. In order for workmen to get to pipe, all water must be pumped from the caisson.

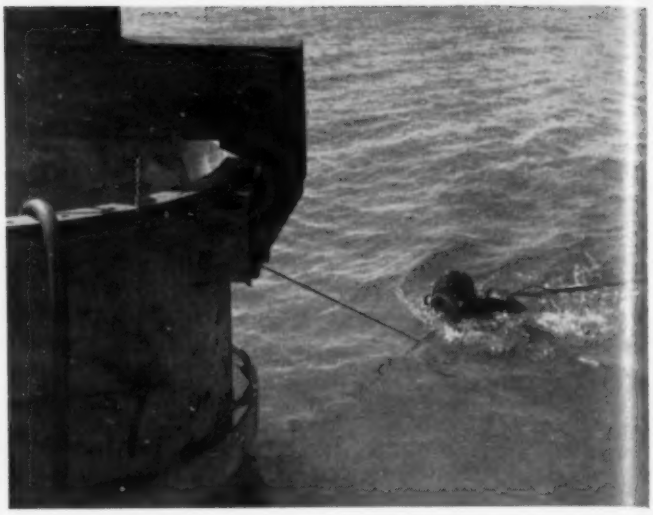


FIGURE 4—Diver prepares to check the position of caisson on the line. To make offshore repairs on lines below surface, two barges are used, one to carry caisson and the other for dragline which uncovers pipe.

hydraulic closure system, sealing gaskets and internally hinged jaws. The hydraulic closure system consists of positive action, 1,500 psi hydraulic rams, manifold piping and hoses. The system is actuated by an external and separate pumping system.

Seals between the hinged sections of the bell and around the pipe line are accomplished by sponge neoprene gaskets under compression. Positive and constant pressure is maintained on the jaws while the caisson is in place over the pipe. A nylon reinforced neoprene sleeve affords a tough and elastic seal between the sections and the cylindrical section.

Located in one of the legs of the caisson is a pneumatic sump pump for water-freeing the caisson in its position on the pipe line. With an external and separate air supply of 100 cfm at 100 psi, the pump has a capacity of 300 gpm against a 50-foot head. Air supply and discharge piping is integral with the caisson, and extension sections and connections are of the fast disconnect type. The pump can be operated in the caisson or remotely from the barge.

The caisson not only decreased working time, which Interstate personnel estimate would have taken five days with conventional methods, but it also eliminated the danger of further damage occurring in bending the pipe when removing it from the water to make repairs.

The caisson was developed within the Interstate Engineering Department by William Law and completed its first field test in 1958 on a 12-inch line in Barataria Bay. The caisson can be expanded with additional six-foot cylinders for deeper lines. It is designed to operate in a maximum depth of 50 feet. For negative buoyancy, iron weights, in 2,000 pound units, are attached to the sides of the bell structure, the number depending on the depth. The basic caisson weighs about 16,000 pounds; with all weights and sections it would weigh around 77,000 pounds. —**The End**

FIGURE 5—After caisson is clamped over the pipe and water is emptied, equipment is lowered into caisson to make repairs. Caisson can be used on pipe up to 20 inches in diameter.

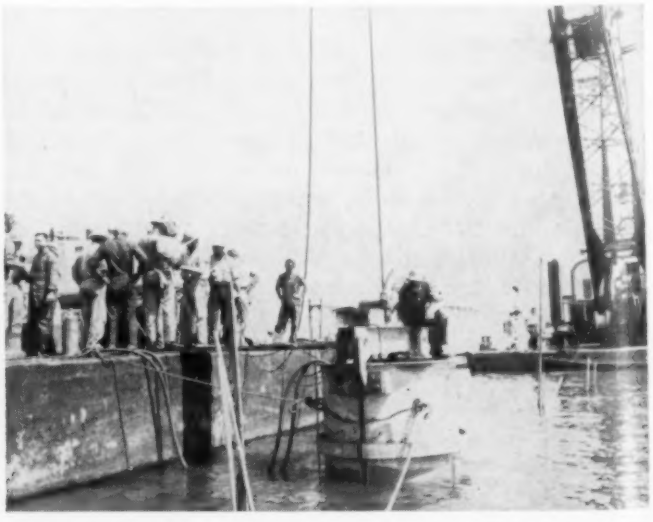
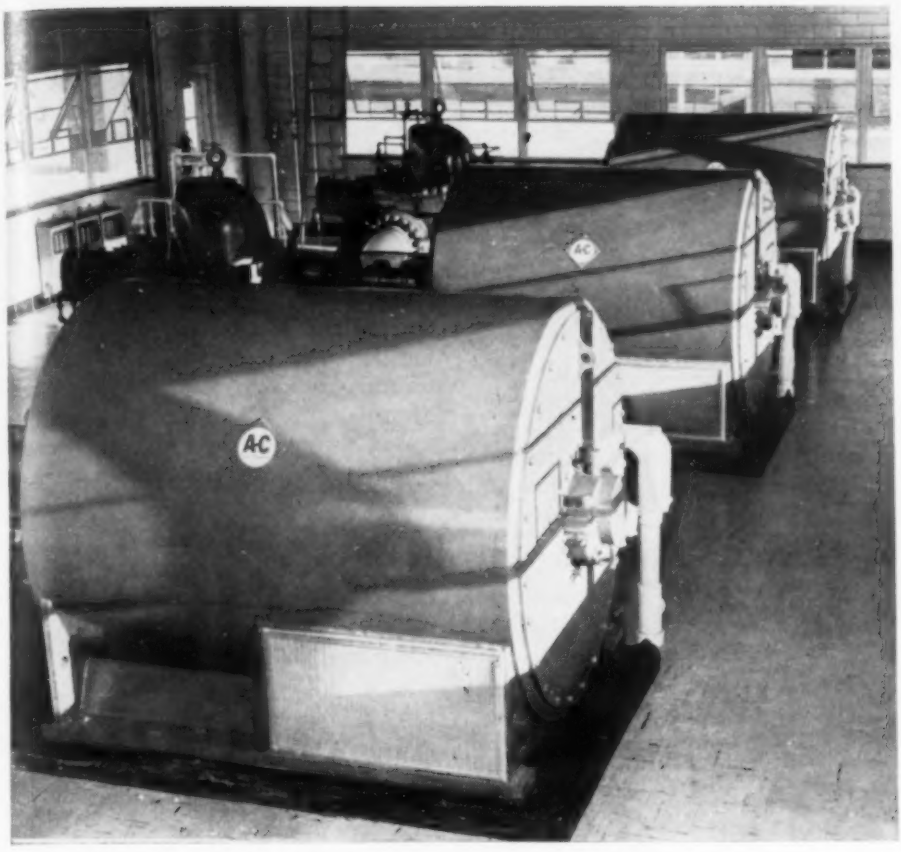


FIGURE 6—Welder makes final check and prepares to descend into the caisson to make repairs. On its first operational use, the caisson completed repair of a 12-inch line in a 24-hour period in one-fifth the time estimated for conventional methods.



Three three-phase, 1,250-hp, 2,300-volt, 1,780-rpm, explosion-proof motors on products pipe line. What happens when the motors are suddenly single-phased? The best way to analyze the problem is by calculating a two-motor drive hooked up to run in opposite directions.

Analyzing Single Phasing Of Three-Phase Motors

Here's a thorough study of motors which will help you understand what happens when one phase is accidentally opened

By R. C. Moore, Motor and Generator Dept.
Allis-Chalmers Manufacturing Co., Milwaukee

IF ONE LINE of a three-phase supply accidentally opens up, two questions arise: Will vital machines keep running or must they be shut down? How much will the motor overheat if it is run on a single phase for a short period?

For answers to these questions, let's review three-phase motor characteristics considering the changes that take place when one phase is opened: When a three-phase motor runs single phase, running torque, efficiency and power factor decrease; current, slip and heating increase, and starting torque is zero.

Several methods can be used to determine the effects of single-phasing and many important performance characteristics of single-phase operation of a three-phase motor may be calculated. Symmetrical component analysis is most useful and utilizes familiar techniques and constants.[1,2]

No-load, single-phase current is easily found. The no-load running current of an induction motor operating from a three-phase supply is readily expressed by the formula[3]

$$I_{3\text{-ph}} = \frac{V_L}{\sqrt{3} \times Z_{po}} \qquad (1)$$

where V_L is terminal to terminal voltage, Z_{po} is the no-load motor impedance and $I_{3\text{-ph}}$ is the no-load current for three-phase motor. A similar expression may be derived by means of symmetrical components to obtain the single-phase no-load running current:

$$I_{1\text{-ph}} = \frac{V_L}{Z_{po} + Z_n} \qquad (2)$$

where Z_n is approximately equal to the three-phase locked rotor impedance:

Divide equation (2) by equation (1)

$$I_{1\text{-ph}} = \frac{\sqrt{3} \times Z_{po}}{Z_{po} + Z_n} \times I_{3\text{-ph}} \qquad (3)$$

For high speed motors the no-load three-phase current can be as low as 16 percent of the full-load current. The per unit Z_{po} is then 6.67 per unit. With a locked rotor three-phase current of 650 percent, Z_n is 0.155 per unit.

For low speed machines the three-phase no-load and locked rotor currents may be 50 percent and 400 percent of full-load current. Z_{po} and Z_n are then 2.0 and 0.25, respectively, in per unit values.

Equation (3) can be rewritten as:

$$I_{1\text{-ph}} = \sqrt{3}\left(1 - \frac{Z_n}{Z_n + Z_{po}}\right) I_{3\text{-ph}} = A I_{3\text{-ph}} \qquad (4)$$

where A varies from 1.70 to 1.60 approximately for high or low speed motors, respectively. However, appreciable variation of Z_n does not greatly affect the relation between single and three-phase no-load current. A rough estimate can be made that the no-load single-phase current is slightly less than

$$I_{1\text{-ph}} = \sqrt{3}\, I_{3\text{-ph}} \qquad (5)$$

Calculations to determine the single-phase locked rotor current of a three-

phase motor may be made using formula (1) except that Z_{po} is now replaced by Z_n. The full voltage single-phase locked rotor impedance of a three-phase motor may then be expressed by the following relation:

$$I_{1-ph} = \sqrt{3}\,\frac{Z_n}{2\,Z_n}\,I_{3-ph} = 0.866\ I_{3-ph} \qquad (6)$$

where currents are locked rotor values.

The single-phase locked rotor current for a three-phase motor is, therefore, 86.6 percent of the three-phase locked rotor current.

Two-motor drive simulates single-phase operation. Many single-phase performance characteristics of a three-phase motor cannot be obtained by simple formulas as are no-load and locked rotor currents. However, for single-phase performance determination, the actual three-phase motor operating from a single-phase supply, shown in Figure 1A, may be replaced by the two mechanically connected motors of Figure 1B. Each motor is identical to the actual motor of Figure 1A and operates from a three-phase supply. The stator windings of the two motors of Figure 1B are connected in series as shown and winding connections are made so that the air gap magnetic fields of the two motors rotate in opposite directions. With the motors thus connected, the torque output of the two-motor system is the difference of the individual motor torques.

From the two-motor arrangement, torque, horsepower output, power factor, losses, can be made for single-phase operation. The advantage of this arrangement (Figure 1B) is that familiar three-phase methods of calculation can be used for each motor and the results may then be combined to obtain the single-phase operating characteristics of the actual three-phase motor.

Circuit representation of the two series-connected motors may be made in the manner shown in Figure 2. If the "positive sequence" motor develops more torque than the "negative sequence," it will determine which direction of rotation the two-motor system drives the load.

At standstill, slip = 1.0, because each motor develops identical torque in opposite directions and the net shaft output torque is zero. In Figure 2, that portion of the circuit from terminals A to C describes the positive sequence in a familiar three-phase circuit form.[4] The remaining portion of the circuit from C to B similarly describes the negative sequence. In the solution, the complete circuit from terminals A to B may be reduced to a single impedance from which the current I_p and I_n may be determined from the impressed voltage V.

Analysis of single-phase operation. Constants for a 400 hp, 1800 rpm, 220 volt three-phase squirrel-cage induction motor show how single-phase operating characteristics are found. For this motor (resistance and reactance values in ohms):

$r_{1p} = r_{1n} =$ 0.195 stator resistance, terminal to neutral

$x_{1p} = x_{1n} =$ j1.47 stator reactance, terminal to neutral

$r_{2p} = r_{2n} =$ 0.400 rotor resistance, terminal to neutral

$x_{2p} = x_{2n} =$ j1.32 rotor reactance, terminal to neutral

$r_{Mp} = r_{Mn} =$ 11.4 magnetizing reactance, terminal to neutral

$x_{Mp} = x_{Mn} =$ j.71 magnetizing reactance, terminal to neutral

$V = 2200/\sqrt{3} =$ 1270 volts, terminal to neutral

s = slip = rpm difference between synchronous and operating speed divided by synchronous speed.

The rotor constants for the negative sequence motor are shown equal to those of the positive sequence motor. In some types of squirrel-cage induction motors using skin effect bars r_{2n} and x_{2n} may be different from r_{2p} and x_{2p}, since the rotor frequency of the negative sequence motor is much higher than the rotor frequency of the positive sequence motor.

If desired, a further simplification may be made in the negative sequence portion of the circuit by removing the magnetizing branch. The parallel rotor branch impedance in this portion of the circuit is considerably smaller than the magnetizing impedance.

By assuming a value of slip, the complete circuit can be reduced to a single impedance consisting of a resistance and reactance in series. Current I_p, which equals I_n, may then be calculated from the impressed voltage V and the circuit impedance. The symmetrical components method shows that the desired single-phase line current, I_{1-ph}, of the motor of Figure 1A is equal to

$$I_{1-ph} = \sqrt{3}\,I_p \qquad (7)$$

where I_p is calculated from the equivalent circuit of Figure 2.

The individual motor horsepower and torque values can be determined for the portions of the circuit applying to each motor. Delivered shaft torque is represented by the difference of the motor calculated values, because the negative sequence motor torque subtracts from the positive sequence motor torque.

Single-phased motor current is larger. Using the circuit of Figure 2, calculated data for single-phase slip, speed and line currents are shown in Figures 3, 4 and 5. The data calculated apply to the motor in Figure 1A when operating single phase. The calculated points found from the circuit solution give results which predict very closely the test made on the 400 hp motor shown in Figure 1A. For comparison the normal three-phase test curves are also shown in the figures.

Figure 4 shows that for three-phase operation with a 400 hp load, motor speed is 1,748 rpm. When one supply line is opened, the motor operates single phase and will develop torque at 1,728 rpm to carry 388 hp. Reference to Figure 5 shows that motor-line current increases from 92 amps three-phase, to approximately double that amount for single-phase operation when one supply line is opened. Proper protective devices would then remove the motor from its supply to prevent excessive stator winding heating.

Voltage across series connected motors varies with speed. After calculating the impedances and the current of the two motors of Figure 1B, represented by the circuit of Figure 2, the voltages across the two motors may be found.

When the motor speed changes from a lower to a higher value, the impedance of the positive sequence motor increases rapidly near the higher speed range accompanied by an increasing voltage across the motor as shown in Figure 6. Correspondingly, the voltage across the negative sequence motor decreases as the speed

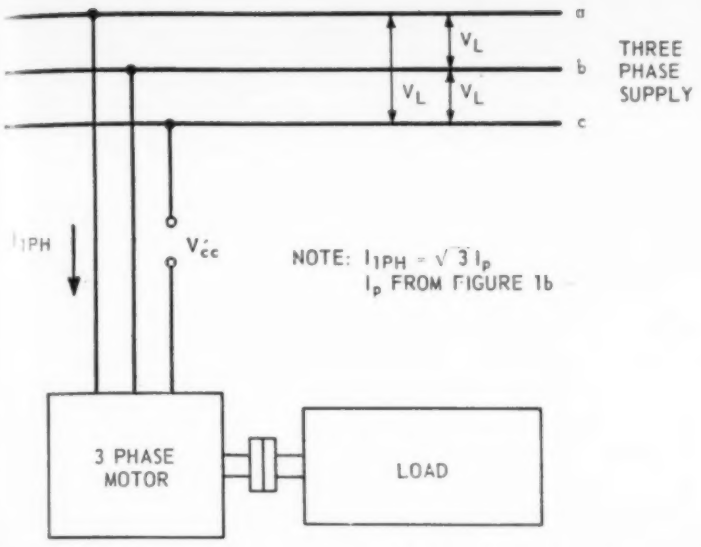


FIG. 1A—This three-phase motor which is accidentally operating on single phase can best be understood by considering it to be . . .

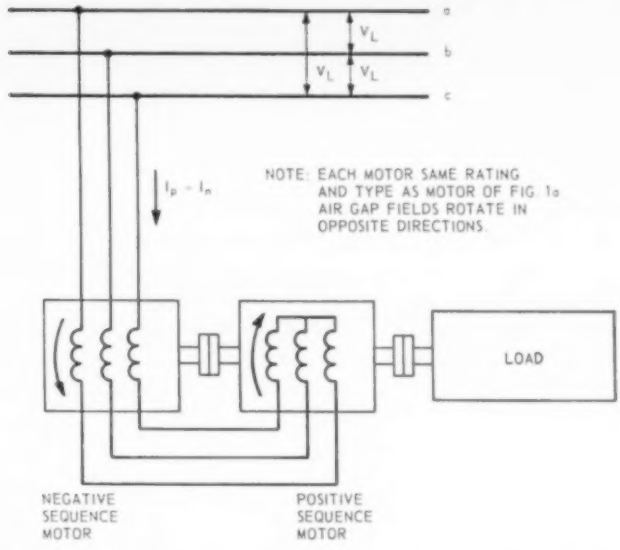


FIG. 1B—Two three-phase motors hooked up to turn in opposite directions. This will give the solution to problems of single phasing a three-phase machine.

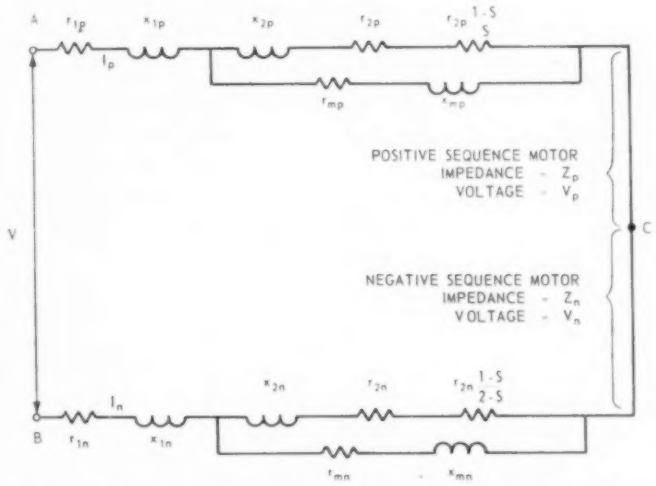


FIG. 2—Circuit representation of the motors in Fig. 1B helps to determine performance when operating single phase.

SYMBOLS:

r, x = resistance, reactance, resp., ohms terminal to neutral
1, 2 = primary, secondary, resp. (primary is usually the stator)
p, n = positive, negative, resp.
m = magnetizing
S = slip (slip rmp divided by synchronous rpm)
$V = V_p + V_n = V_L/\sqrt{3}$ NOTE: V_L from Figure 1.

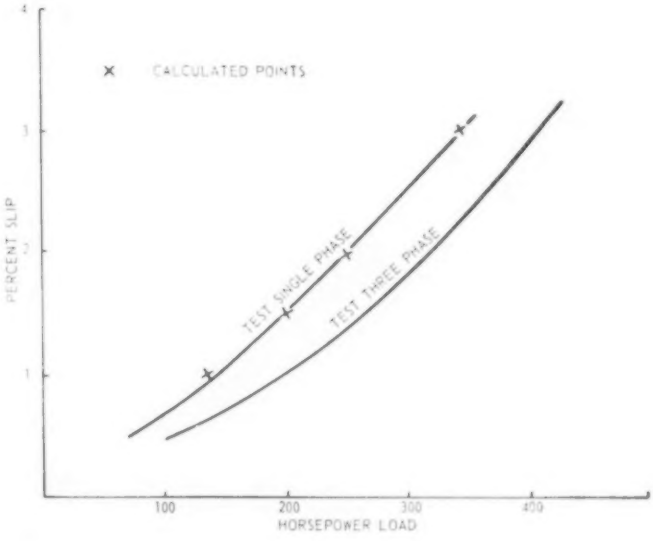


FIG. 3—Slip test curves indicate the speed change for both single and three-phase operation with various horsepower loads.

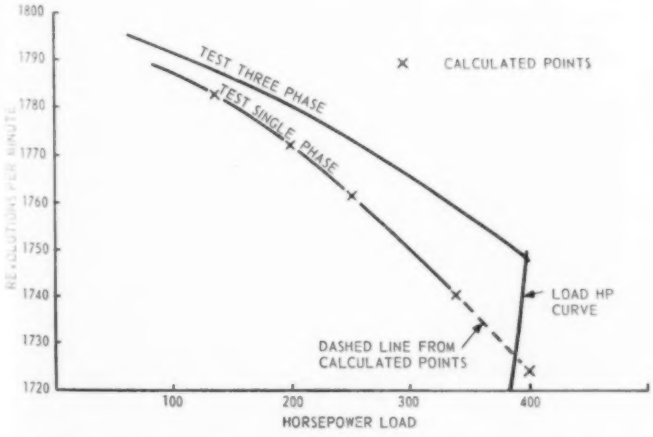


FIG. 4—Speed change curves show how speed changes for both single and three-phase operation for various horsepower loads.

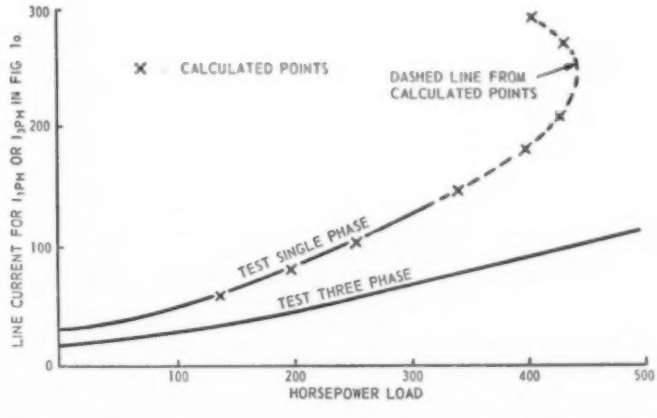


FIG. 5—Current curves indicate the increase in line current encountered when operating a three-phase motor single phase.

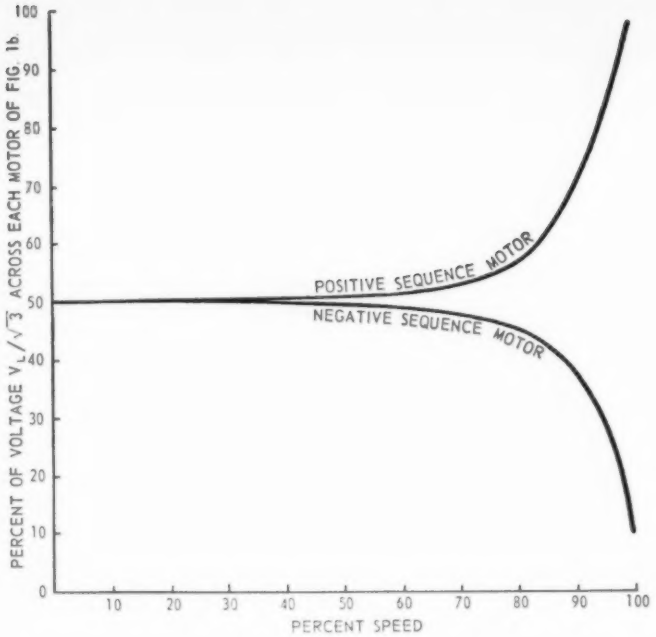


FIG. 6—Curves developed from calculated data show the division of voltage across the two series motors in Figure 1B.

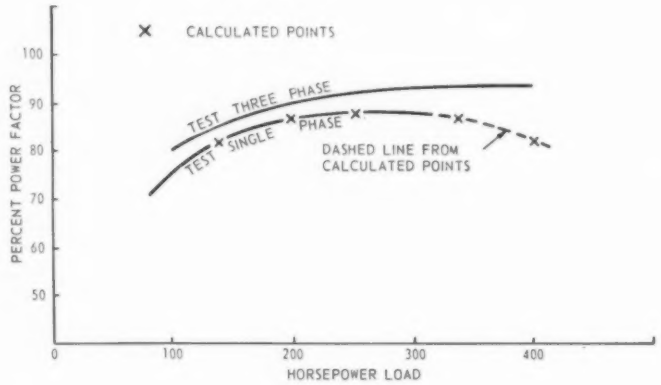


FIG. 7—Power-factor curves show the changes in power factor that result when operating a three-phase motor on single phase.

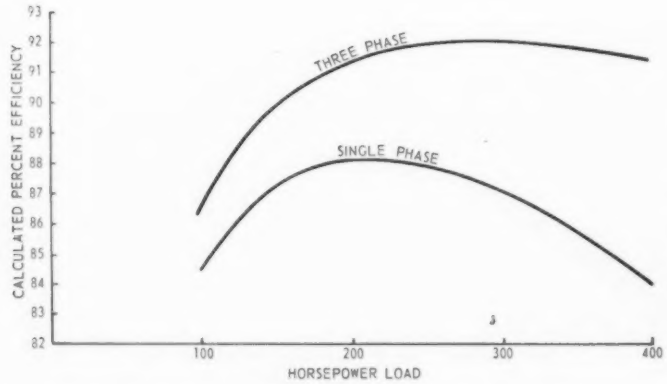


FIG. 8—Calculated efficiency of normal operation and operation of the three-phase motor while single-phasing are compared.

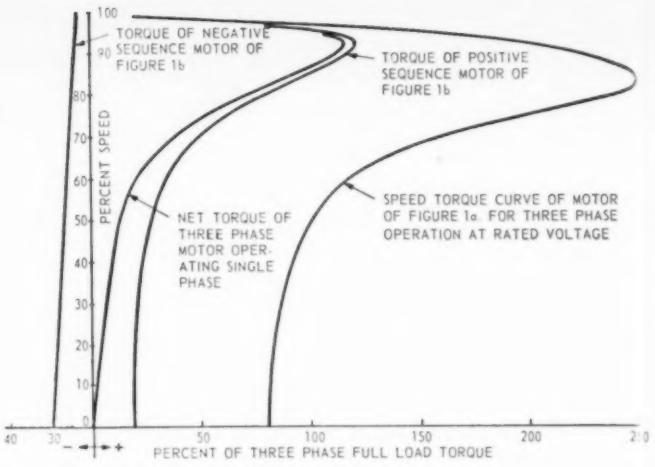

TORQUE OF NEGATIVE SEQUENCE MOTOR OF FIGURE 1b
TORQUE OF POSITIVE SEQUENCE MOTOR OF FIGURE 1b
PERCENT SPEED
NET TORQUE OF THREE PHASE MOTOR OPERATING SINGLE PHASE
SPEED TORQUE CURVE OF MOTOR OF FIGURE 1a FOR THREE PHASE OPERATION AT RATED VOLTAGE
PERCENT OF THREE PHASE FULL LOAD TORQUE

FIG. 9—Single-phase torque values are considerably reduced when phase is opened and three-phase motor operates single-phase.

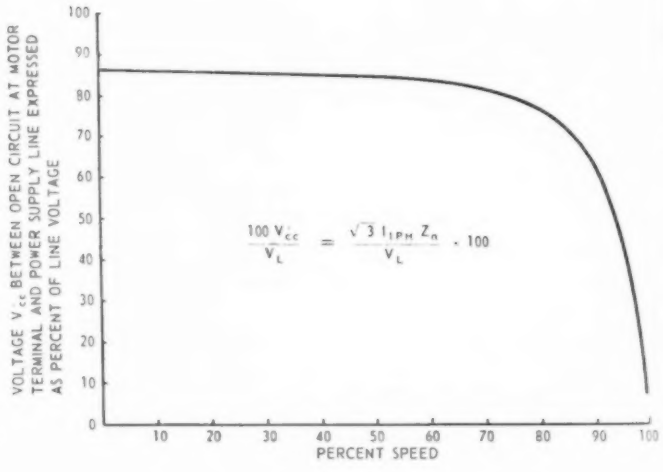

VOLTAGE V_{cc} BETWEEN OPEN CIRCUIT AT MOTOR TERMINAL AND POWER SUPPLY LINE EXPRESSED AS PERCENT OF LINE VOLTAGE
$\frac{100\ V_{cc}}{V_L} = \frac{\sqrt{3}\ I_{1PH}\ Z_n}{V_L} \cdot 100$
PERCENT SPEED

FIG. 10—Curve shows the calculated voltage between the motor and the broken supply line when single-phase operation occurs.

About the Author

Robert C. Moore is an electrical engineer with the induction and synchronous machine design group of Allis-Chalmers Mfg. Co. He joined that company in 1928 after receiving his B.S. degree in electrical engineering from the University of Michigan. He completed further studies at the University of Wisconsin, Marquette University and Illinois Institute of Technology. Moore has authored several papers for the AIEE, and numerous articles for trade publications. During World War II, he received an award for his participation in the Manhattan District Project.

R. C. Moore

increases. The fraction of the line voltage which appears across each motor may be expressed by the following relation:

$$V = V\left[\frac{Z_p}{Z_p + Z_n} + \frac{Z_n}{Z_p + Z_n}\right] \quad (8)$$

The fraction $\frac{Z_p}{Z_p + Z_n}$ gives the per unit voltage across the positive sequence motor and similarly the fraction $\frac{Z_n}{Z_p + Z_n}$ gives the per unit voltage across the negative sequence motor. The impedances in the fractions are, of course, vector values. Calculated results from the circuit of Figure 2 are shown in Figure 6. The curves indicate that near full speed the braking torque developed by the negative sequence motor may be expected to be small since the voltage across the motor is small.

Power factor and efficiency are less for single-phase operation. Power and efficiency curves are plotted in Figures 7 and 8 for both single and three-phase operation of the 400-hp motor. The efficiency curves shown are from calculated data. For a given horsepower, loading the efficiency for single-phase operation is less, as might be expected, largely because of the high stator line current and higher slip losses as compared to three-phase operation. Only two-thirds of the stator winding is in use during single-phase operation. However, the considerably larger line currents of single-phase compared to three-phase operation results in an overall stator copper loss being higher for the single-phase operation.

To find the shaft torque for single-phase operation of a three-phase motor, the two-motor system is again to be used with the equivalent circuit. Calculations to determine the torques of each motor may then be made and their difference taken to obtain the net output torque on a single-phase supply. The calculated speed-torque curves of Figure 9 show that in the normal operating range the braking torque of the negative sequence motor is very small compared to the torque developed by the positive sequence motor. The curves representing the torque contribution of each sequence motor and the resulting torques are shown. The net torque for single-phase operation is appreciably less than three-phase torque values. The two-motor system shows that a motor operating on single phase has no starting torque at standstill. Each motor develops the same torque but in opposite directions.

The torque curve in Figure 9 for the positive sequence motor may also be obtained by multiplying the three-phase values for a given speed in Figure 9 by the square of the percent voltage found from the upper curve of Figure 6.

Breakdown torque of an induction motor for single-phase operation is considerably lower than for three phase. This may be expected from a study of Figure 6 which indicates that the voltage across the positive sequence motor and hence its torque decreases rapidly during the initial 20 percent speed drop.

Single-phase heating greater than three phase. Load losses are greater for single-phase than for three-phase operation. Stator and rotor copper losses may show considerably increase. In the 400-hp motor example being studied, the near full-load single-phase stator current is about twice the three-phase value. Since only two-thirds of the stator winding is used during single-phase operation, the ratio of the single to three-phase copper loss is $(2)^2 \times \frac{3}{2}$ or 270 percent considering only the current change. The loss may be further increased because resistance increases with temperature. The loss increase thus estimated does not, however, permit a direct evaluation of temperature rise of the stator winding on single phase, because the individual winding conductors on single operation are actually carrying twice the current, which is four times the conductor copper loss of three-phase operation.

Single-phase rotor losses are greater than three phase for a specified motor loading. The negative sequence motor of Figure 1B develops rotor loss in producing a braking torque. This loss added to the positive sequence motor losses represents the total rotor loss of the motor of Figure 1A operating single phase. At a load of approximately 400 hp the sum of the calculated single-phase rotor loss of both motors of Figure 1B was 250 percent of the normal three-phase value.

Motors with skin effect type rotor bars may have a resistance r_{2n} in the equivalent circuit of Figure 2 several times the value of r_{2p}. A range of r_{2n} three to five times r_{2p} may not be unusual. The rotor loss increase in such motors may be considerable. Therefore, to properly evaluate the thermal capability of a three-phase motor on single-phase supply, it is very important to know details of the motor design and construction.

Voltage between motor leads and disconnected power line may be high. Application of the method of symmetrical components may be made to find the voltage V'_{ee}, Figure 1A, across the open circuit between the motor terminal and the disconnected power line.[5] The open circuit voltage may be expressed as:

$$V'_{ee} = 3\, I_n\, Z_n = \sqrt{3}\, I_{1\text{-ph}}\, Z_n \quad (9)$$

The voltage V'_{ee} is shown in Figure 10 and is about proportional to the single-phase line current, because Z_n is essentially constant from standstill to full speed for the 400 hp motor tested.

The impedance, Z_n, of the negative sequence motor in Figure 2 with skin effect rotor bars may decrease from standstill to full speed. For this type of motor V'_{ee} may be slightly less at the higher speeds than shown in Figure 10.

The curve of V'_{ee} in Figure 10 may also be obtained by multiplying by 3 the lower curve of Figure 6 which represents $I_n Z_n$, the voltage across the negative sequence motor.

The normal three-phase characteristics of an induction motor may be altered should one of the power supply lines be disconnected from the motor. In normal applications, where the torque characteristcs of the load increase with speed, the motor speed will drop slightly for single-phase operation. Accompanying the decrease in speed motor efficiency, power factor and breakdown torque decrease. Motor-line current increase may be large, so that the motor will overheat because of the increased copper losses. When single phasing may be expected to occur, the motor should be protected by overcurrent devices, thermal relaying or other suitable means.

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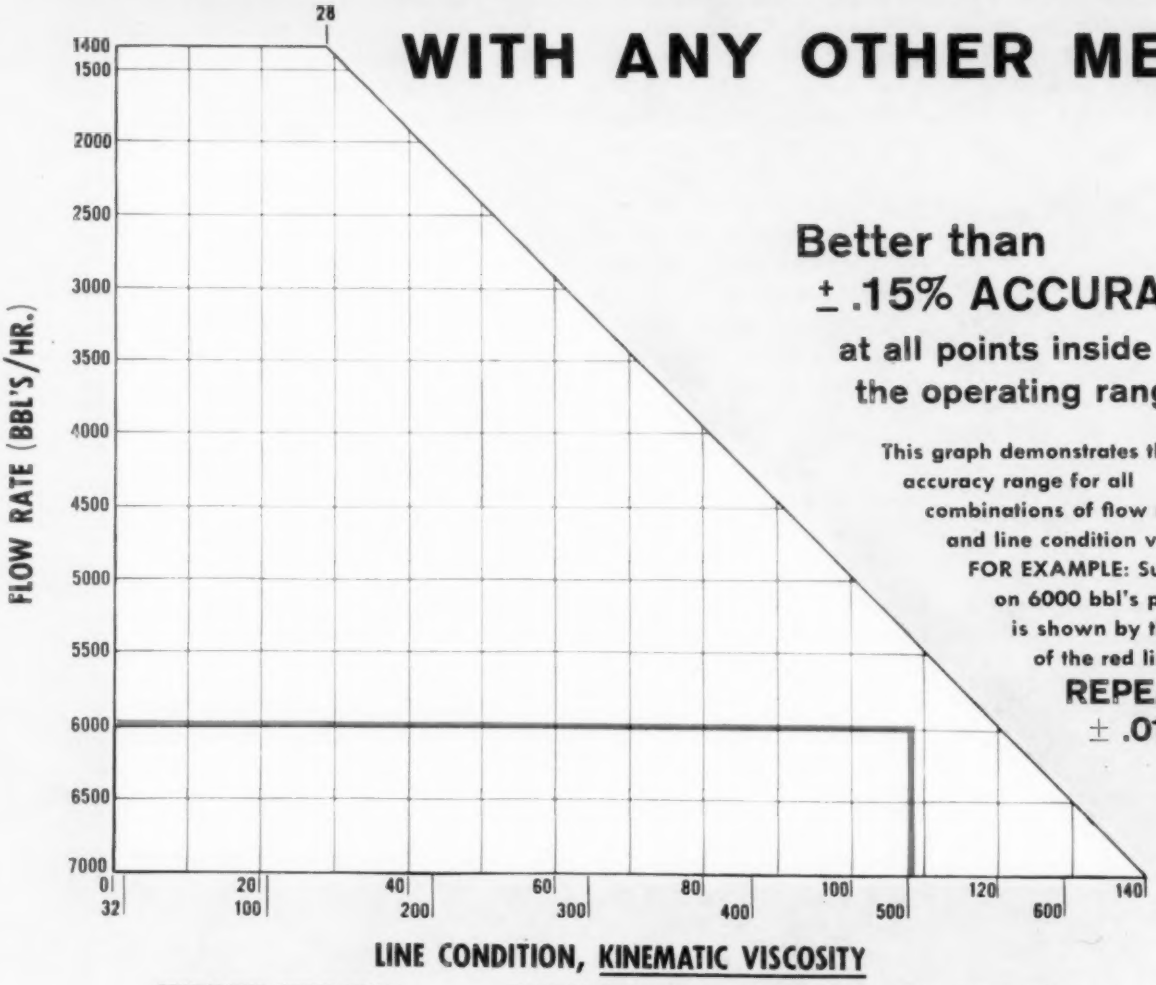

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Speak Up When Disaster Strikes

In times of crisis, your company's reputation with employes and community is at stake. Here's how management can keep a plant disaster from becoming a public relations disaster

By Henry H. Hunter
Director of Public Relations
Olin Mathieson Chemical Corp.
New York

A RECENTLY PUBLISHED book titled, "The Diary of a Strike," states, "The best of all possible moments to achieve insight into the life of a human being is during a fundamental crisis, when he is faced with grave decisions which can mean ruin and despair or success and happiness."

General S. L. A. Marshall points to the same conclusion in his studies of warfare—that the true nature of a man emerges only in times of emergency, stress and crisis.

In the same way that a personal crisis makes or breaks a human being, a public relations crisis becomes the "moment of truth" for a corporation. And by far the most critical and dangerous public relations crisis that a company can face is the plant disaster—the explosion, fire or other accident that causes death, injury and destruction.

That Sudden Change. Consider what happens to a company when disaster strikes. In one moment, it's peaceful routine and business as usual. The company is trying to conduct itself in a way that deserves the respect of customers, employes, stockholders and neighbors. It conforms to certain public relations policies, all designed to demonstrate the soundness and maturity of its management, the quality of its products, its advantages as a place of employment, and its concern for the welfare and security of its employes.

One moment later disaster strikes. And, as Artemus Ward once said: "The fack can't be no longer disgised that a Krysis is onto us." Within seconds, all the progress ever made in earning and deserving the good will of the public is up for grabs. Every act and statement designed to win the confidence of employes, customers and the community is on the line for possible eclipse.

It Can Happen to You. Now, a disaster can strike any company. No one is immune. Even with the remarkable safety record of the chemical industry, not a single chemical company can say "it can't happen here."

Then why do many companies fall down under the pressure of an emergency? Why is it that so many companies—large or small, with well-trained public relations personnel or without—handle themselves so badly when the chips are down?

The reasons, in my opinion, are three:

1. They Aren't Prepared. They have no pre-arranged policy to guide them in an emergency. This is a tragic omission, especially when the layman comes to grips with the public relations problems a disaster creates. Many good business executives, under the pressures of a public relations emergency, will bounce in the wrong direction every time. The reason is that every instinct of a person inexperienced in public relations

causes him to do exactly what he must not do.

2. Panic. The only way to eliminate most of the mistakes that panic can lead to is to provide emergency guidance—in advance—and in such detail that the decisions to be made under stress are kept to a minimum.

3. Lack of Executive Understanding. This involves the difficulty many executives have in understanding the duties, responsibilities and requirements of the press. When reporters and photographers arrive on the scene of a major disaster—and arrive they will—it's easy to view them as a hostile group who can do a great deal of harm. Harm they can do—but hostile they are not. At least, not until you earn and deserve hostility.

The plant official is quick to recognize that between himself and the press there is a conflict of interest and, in sensing this, he is usually right. But he often fails to realize that there is also a way to accommodate his interests with theirs and that in this accommodation, lies the only real solution to his dilemma.

Western civilization treasures freedom of choice and the philosophical conception of free will. The hardest thing in the world to do is to tell a man that in a given situation he has no freedom of choice. Yet—and this may be a blissfully pig-headed statement—where handling the press in a disaster is concerned, there is no freedom of choice. One road leads straight to hell and the other to purgatory. And when your plant goes up and people are killed, journalistic purgatory can be a relative heaven.

It's true that some companies handle themselves so skillfully in a crisis that they come out with an added measure of sympathy and respect. But what we are mainly concerned with is avoiding those common mistakes that can haunt a company for years.

Case History. One summer day eleven years ago, a little before the lunch hour, a fire broke out in the main plant of a very well known industrial corporation. By 12:30 the fire was raging out of control. All the fire fighting apparatus of a large city was arriving on the scene and, with it, the inevitable corps of reporters and photographers from newspapers, wire services, radio and television.

Guards at the plant gates received these orders from management shortly after the fire began: "Let the firemen in, keep the newspapers out."

During the afternoon the zealous guards at the plant gates chalked up these significant public relations triumphs: One reporter was hit in the nose; a photographer's camera was deliberately smashed; another reporter was ejected from the grounds after he had sneaked in and was caught interviewing employes.

Still Feeling Repercussion. It's no surprise that these three newsmen's attitude toward the company became unenthusiastic. It's no surprise, either —at least to any one in public relations—what a tremendous price the company paid for a few hours of sheer stupidity. Twice since then the company has been the victim of large and nationally critical strikes that have made newspaper headlines coast to coast. In every case, newspaper coverage of these was less sympathetic toward the company point of view than it might have been.

News stories the company wanted to see appear—marginal news value stories on local developments that were designed to insure a good labor pool, or new product stories designed to help build customers—either wouldn't run at all, or if their news value was undeniable, were given secondary or critical treatment.

And further, in the absence of a favorable press, it is hard to imagine that the job would have been any easier had the company had to go to the community for favors such as industrial rezoning or requesting a lower tax assessment.

Still and all, maybe all of this would have been worth while if the company had accomplished something of major consequence by its original decision of trying to shield the disaster from the press. But just what was accomplished?

Lengthy Treatment. Newsmen buttonholed firemen and employes leaving the scene and pieced together stories from often exaggerated and distorted facts. The mystery surrounding the fire kept it in the headlines for weeks, long after it would have made news if the true facts had been known. And in the absence of any official information, every unfounded rumor was given prominent treatment.

The story the company didn't want to run ran anyway. The action taken by the company accomplished nothing. On the negative side, however, the company accomplished a public relations debacle that turned out to be a greater disaster than the fire itself.

Whose fault was it? There is really not much doubt it was the fault of management. But if you asked management itself whose fault it was, you'd have gotten a different answer. In their eyes, the villains in the piece were the newspapermen. This isn't unusual in such a situation. When the corporate walls come tumbling down as the result of bad press coverage, the culprit is often a specific newspaperman or that generic villain, "irresponsible reporting."

This comes up so many times that it's worth considering—what is irresponsible reporting?

Two questions must be asked. Whose irresponsibility and whose reporting?

What Is News? A story that seems irresponsible to a company executive may well meet the highest standards of the country's best run city desk, because as you know, the criteria are different. When Adolph Ochs adopted the slogan for the *New York Times*, "All the News That's Fit to Print," he reserved for the Times the right to measure fitness.

If a newspaper or magazine carries an honest story about a plant disaster that reflects badly upon the company, this is a legitimate cause of concern to company management. But it is not the prime concern of a newspaper or its reporters. Their concern is to tell the story as best they can with all the facts that are available.

This brings us to the second question about "irresponsible reporting" —whose reporting?

Reporters Need Facts. When a reporter gets an assignment, he is expected to return with a story. This is his job. It is his instinct to seek the most authoritative source available for the facts he needs. In the situation of the fire which we discussed before, the most authoritative source was, of course, company management. But management would not

talk to the reporters, so there was only one course open to them. They had to get a story and they had to get it fast. So they did what you or I would have done. They talked to the people who had seen what happened. These were mostly employes, many of them shocked by narrow escapes, unnerved by the frenzy and confusion, and prone to exaggerate both the damage and the danger.

From the company point of view, they were the worst possible sources. Yet it was management itself that forced reporters to rely on these secondary sources.

Now, officials of this company were men of intelligence, ability and sound judgment. Their decisions during the fire were made because they honestly considered they were in the best interest of the company. The fact that they were so wrong in everything they did was due simply to their ignorance about news and the people who gather it.

Poor Communications. The failure of company officials to establish a sound working relationship between themselves and the press underlies almost every instance of botching the public relations aspects of a plant disaster.

The prime reason for this is the happy hope that by refusing to meet with the press, we can keep the story of our misfortune out of the newspapers. The fact is, of course, we can't. As soon as an event becomes a matter of concern and interest to a community, the newspaper will do everything in its power to get the story. This it regards not only as a right but a duty.

No one likes bad news, particularly those most intimately touched by it. But the people of any community are interested in it and the newspaper's prime allegiance is to the community and its readers.

The reporter who phones and asks for our earnings figures in advance will respect our right not to divulge them. If he hears a rumor about a new product or process, he can sympathize with our efforts to keep it secret. But if disaster hits a plant and touches the life of a community, he will dig deep for all the facts he can get. Inevitably and irrevocably he will publish the story. And he will work at a story for days, if necessary, to get all the facts his editor wants.

Story Will Run. If we can accept this as a basic premise, we take a giant step toward handling the press properly. Once we accept the fact that the story will run, we can turn our attention to what it will say. And it is here, and only here, that management can affect the result. While no one, by pressure or persuasion, can keep the story out, intelligent press relations can earn the respect, understanding and even sympathy of the press at a time when it counts.

In the days when the airline industry practiced Model T public relations, they tried to keep all stories of plane crashes out of the papers. When a plane did crash, squads of men were rushed to the scene to keep the prying eyes of the press at a distance. Sometimes, they even splashed buckets of paint over the name of the airline to keep it from showing in news photos. They refused to divulge the names of the casualties. Their answer to every question from the press: A terse "no comment."

Then one day, so the story goes, a public relations man was hired from another industry to fill a minor post for a major airline at a southern airport. In his first evening on the job, his new employer dropped an airplane right in the middle of the runway. Before he had been indoctrinated with his employer's principles of press relations, he had a job to do. He did it by instinct.

PR In Action. He first phoned every newspaper, wire service and radio station in the city. He introduced himself, told them what had happened, and where at the airport he could be found. He obtained a copy of the passenger list, found out how long it would take to notify the next of kin, had the list reproduced and marked it for release the next morning. He typed a statement saying that the cause of the crash was unknown but that an investigation would begin immediately.

All this material he gave to the press when they arrived. He also did everything else he could to be helpful.

The next morning, the crash made headlines from coast to coast. His bosses were furious and they hauled him to headquarters to be fired. But first they gave him a hearing.

At the meeting, he compared the newspaper coverage of this crash with one six months before. The crash he handled made banner headlines in the morning papers. That evening, it moved back to Page 3. The next morning, the papers carried nothing.

Out and Over. The crash that had happened previously made lively news for nearly a week while reporters probed and dug for additional facts. As each new fact was brought to light, it made another headline. The reason the second crash was covered in one day is that in one day the papers had the entire story. When there was nothing more to say, and they closed the books.

"Which would you prefer," he asked them at this rather memorable meeting, "to remind people of an accident in every edition for a week or to get the story out and get it over?"

From this day on, the public relations policies of airlines, railroads and others who must live under the constant threat of banner-headline tragedy, have become among the most enlightened of all industries.

Rules for Disaster. If all the experiences that any of us have had in the public relations handling of a disaster can point to a valid set of rules and principles, then maybe our collective mistakes have been worthwhile.

I believe there is such a set of principles and, in summary, here they are:

1. Make one person responsible for handling the press in times of an emergency. Assign him this responsibility in advance—not after the disaster happens. Make this his only responsibility in a disaster situation. And choose a man who understands at least the fundamentals of good press relations.

2. Anticipate the questions the press will ask and begin to get the answers immediately. Basically they will want to know: What happened and what caused it; name, address, age and job of any casualties. Of course, this should not be given until families are notified. Also the nature and cost of the damage, and whatever plans you have for rebuilding and resuming operations if they were interrupted.

3. Inform all news media as quickly as possible. If the accident is a minor one, they will probably be content to take the information over the phone. If major, they may

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want to cover it in person. If they do, tell them that you will do your best to answer their questions, give them the name of the man in charge of assisting them and ask them to contact him when they arrive at the plant.

4. Set aside a room to serve as press headquarters. Choose one that has as many phones as possible and ask the switchboard to expedite any calls on these phones.

5. Make whatever arrangements with plant guards and security people to get the press into the plant and make sure they are handled courteously.

In short, establish the company as the source for the information they used and get them the facts they want as quickly as possible.

And as the pressure mounts, remember that the spotlight of public attention is focused upon you. That public opinion, always a fickle mistress, will be poised to move with you or against you—according to how you act under crisis.

Originally presented before the American Chemical Society, 1959, Boston meeting.

About the Author

Henry Hunter is a director of public relations for Olin Mathieson Chemical Corp., New York. He attended Williams College from 1941-45, and after wartime military service attended the University of Missouri School of Journalism. During the years 1949-51 he was successively assistant city editor, Champaign, Ill., *News Gazette;* assistant managing editor, Irving Cloud Publishing Co., and assistant publicity director, Ross Roy, Inc., Detroit. From 1951-54 he was assistant public relations director, Grant Advertising, New York. Hunter then joined Olin Industries to manage product publicity. When the company merged, he became Olin Mathieson Chemical's publicity manager. In 1955 he was named assistant director, public relations, and attained his present post in 1957.

The author checks the pipe-to-soil potential of an asphalt-coated line. All five of the lines described here were checked out twice on approximately one-mile intervals. The test will be continued until current requirements for cathodic protection stabilize.

How Asphalt Coatings Are Holding Up in the Ditch

Annual inspections provide increased knowledge of in-the-ditch performance and ultimately a more accurate evaluation of coatings before installation

By **Pearce Butterfield**
Consulting Corrosion Engineer
Houston

PRECISE DATA on in-the-ditch performance of pipe coatings taken at regular intervals over extended periods of time ought to be of genuine value to the pipe line industry. This was the thought behind Gulf States Asphalt Company's move to provide customers with periodic coating conductance tests for coatings in actual service. Here are partial results of such tests carried out during the past three years on lines that have been in service up to five years.

The lines involved in the tests are located in various parts of the country; over-all objectives of the test are to determine the coating resistance in ohms per square foot as it ages in service, and to determine the amount of current required to provide cathodic protection for the lines under normal operating conditions.

How Tests Were Made. All sections of line tested were adjacent to rectifiers. The sections varied in length from 7.39 miles to 16.22 miles. An AC operated current interrupter was inserted in the AC power source of the rectifier to switch the current on and off at regular intervals.

Coating resistance was calculated by dividing the average voltage change at the extremities of the section, Δ V, by the current picked up on the section, Δ I. This value is the resistance-to-earth of the section and when multiplied by the square feet of coating in the section gives the average resistance of the coating in the section in ohms per square foot.

Current picked up by shorted casings was deducted from the current values and the sections were insulated from foreign structures and gathering systems or laterals. Table 1 gives the pertinent information on the lines tested and the values obtained.

Coating Comparisons. Probably the most practical method of comparing various lines under cathodic protec-

TABLE 1—*Data on lines tested and values obtained . . .*

Section	Year Laid	Location	Type of Coating	Length of Section Miles	Diameter of Line	Approximate Average Soil Resistance	Average Current Pickup/ Mile	Coating Resistance In Ohms/ Sq. Ft.
1	1955	Mont.	Asphalt, glass, 8# asbestos felt	12.88	12"	Under 5000	0.089	28,000
2	1955	Ga.	Asphalt, glass, kraft paper	8.90	36"	80,000	0.047	555,000
3	1956	La.	Asphalt, glass kraft paper	11.50	36"	7000	0.081	236,000
4	1957	N. Mex. Ariz.	Asphalt, glass, 8# asbestos felt	7.39	16"	Over 100,000	0.1000	141,000
5	1957	Texas	Asphalt, glass, kraft paper	16.22	16"	1000	0.681	7,200

TABLE 2—*Estimated tons of coating for three diameters . . .*

Diameter of Line	Tons of Asphalt Coating per Mile	Cost of Coating per Mile	Total Cost per Mile for Cathodic Protection for 20 Years	Total Cost per Mile for Protecting Pipe for 20 Years
Section 1 (12-inch)	$ 7.25	$304.50	$ 15.13	$319.63
Section 2 (36-inch)	18.00	756.00	7.80	763.80
Section 3 (36-inch)	18.00	756.00	13.80	769.80
Section 4 (16-inch)	9.00	378.00	16.90	394.90
Section 5 (16-inch)	9.00	378.00	114.80	492.80

tion as to the quality of the coating is to determine how much current is required to provide protection for the line under actual operating conditions. This is the most practical method because the coating quality may be expressed in terms of dollars. With the current known, we can derive a dollar value for cathodic protection. The economics of pipe line maintenance is based on the cost of coating and cathodic protection versus the cost of repairing leaks as they may occur.

Cathodic Protection Cost. From data collected in the field, the amount of current being picked up by the line under actual operating conditions may be determined. For a basis of comparing the cost of supplying protection to the test sections, it is estimated that the cost of providing the facilities for cathodic protection is $100 per direct current ampere output of the rectifier. This figure would include right-of-way for the rectifier and groundbed, cost of cable, power poles, anodes and installation. Most rectifiers are designed for a 20-year life. If an estimated 25 percent increase in current requirement for the 20-year life of the system should occur, the initial rectifier cost would be $125 per ampere or $6.25 per ampere per year.

If it is assumed the circuit resistance of the groundbed is one ohm, one watt of power would be consumed in providing this one ampere. However, the transformer and rectifier are not 100 percent efficient. If an efficiency of 50 percent for the rectifier is assumed, the one ampere DC output would represent two watts. If the power cost is estimated at 10 cents per kilowatt hour, the one ampere of current providing protection to the pipe line would cost $1.75 per year. Over a 20-year period, this one ampere would cost $35. If a 25 percent increase in current requirement over the 20 year period is assumed, the cost of one ampere protection would be $43.75.

These estimated costs may vary depending on the soil resistance where the groundbed is located, the value of land where the groundbed is to be installed, type of installation, source of power and several other factors. If all sections are evaluated on the same basis, a valid comparison should result. Following is the estimated cost of cathodic protection for the five test sections:

Section 1	
Current pick-up per mile	0.089 amperes
Cost of rectifier per mile per year	$ 0.57
Cost of power per mile per year	0.20
Total annual cost of cathodic protection	0.77
Cost of rectifier per mile for 20 years	11.13
Cost of power per mile for 20 years	4.00
Total cost of cathodic protection per mile for 20 years	$ 15.13
Section 2	
Current pick-up per mile	0.047 amperes
Cost of rectifier per mile per year	$ 0.29
Cost of power per mile per year	0.10
Annual cost of cathodic protection per mile	0.39
Cost of rectifier per mile for 20 years	5.80
Cost of power per mile for 20 years	2.00
Total cost of cathodic protection per mile for 20 years	$ 7.80
Section 3	
Current pick-up per mile	0.081 amperes
Cost of rectifier per mile per year	$ 0.51
Cost of power per mile per year	0.18
Annual cost of cathodic protection	0.69
Cost of rectifier per mile for 20 years	10.20
Cost of current per mile for 20 years	3.60
Total cost of cathodic protection per mile for 20 years	$ 13.80
Section 4	
Current pick-up per mile	0.100 amperes
Cost of rectifier per mile per year	$ 0.63
Cost of power per mile per year	0.22
Annual cost of cathodic protection per mile	0.85
Cost of rectifier per mile for 20 years	12.50
Cost of power per mile for 20 years	4.40
Total cost of cathodic protection per mile for 20 years	$ 16.90
Section 5	
Current pick-up per mile	0.681 amperes
Cost of rectifier per mile per year	$ 4.26
Cost of power per mile per year	1.48
Total annual cost of cathodic protection	5.74
Cost of rectifier per mile for 20 years	85.20
Cost of power per mile for 20 years	29.60
Total cost of cathodic protection per mile for 20 years	$114.80

Note: No engineering of maintenance charges are included in the above costs.

Test leads and potentiometer-volt meter used in making the tests.

High Protection Costs Result From Poor Application. As the coating resistance appeared to be much lower on Section No. 5 than on other lines tested and the current requirement higher, the coating manufacturer bore the cost of having a Pearson holiday survey made on a section of the line to determine the frequency and cause of coating holidays.

A total of 35 holidays were found on a 2,560-foot section and a sufficient number of these were uncovered to determine their origin. All of those examined were found to be the result of rock penetration on the bottom of the pipe or improper coating application. During construction, the line had been cradled into the ditch directly from the coating and wrapping machine. Apparently one of the coating shoes on the coating machine was not properly spaced and left a

void in the coating. Except for rock indentation on the bottom of the pipe, there was no evidence of indentation or impression of soil particles on the coating. There was no evidence of soil stresses having acted upon the coating. The bond was execellent adjacent to the holidays with no evidence of a lack or deterioration of the bond. Samples of coating were removed from the pipe and physical tests were made in the laboratory to determine if any physical changes had taken place during the period the line was in service. These tests indicated no apparent change in physical characteristics.

With these estimated costs of cathodic protection established for a 20-year period, we can estimate the total cost of asphalt coatings. Ignoring freight and allowing an estimated cost of $42 per ton for asphalt coating, we can arrive at over-all values. The estimated tons of coating per mile for the three diameters is shown in Table 2.

From this information, it is possible to compare the cost and maintenance of asphalt coatings with those of other type coatings. Generally, the cost of application will run about the same for all hot applied coatings.

These tests will be continued in the future, and when the information is correlated with the chemical composition of the coatings, it will be possible to accurately forecast the performance of the coatings over long periods of time. —**The End**

About the Author

Pearce R. Butterfield is a consulting engineer in the corrosion field. Prior to going into business for himself, he was in the Corrosion Engineering Department of Transcontinental Gas Pipe Line Corp. Butterfield graduated from the University of Kansas in 1948 with a B.S. in civil engineering. He went with Phillips Petroleum Co. doing surveying work until 1950 when he joined Trunkline Gas Co. He joined Transco in 1952 and remained until February 1958.

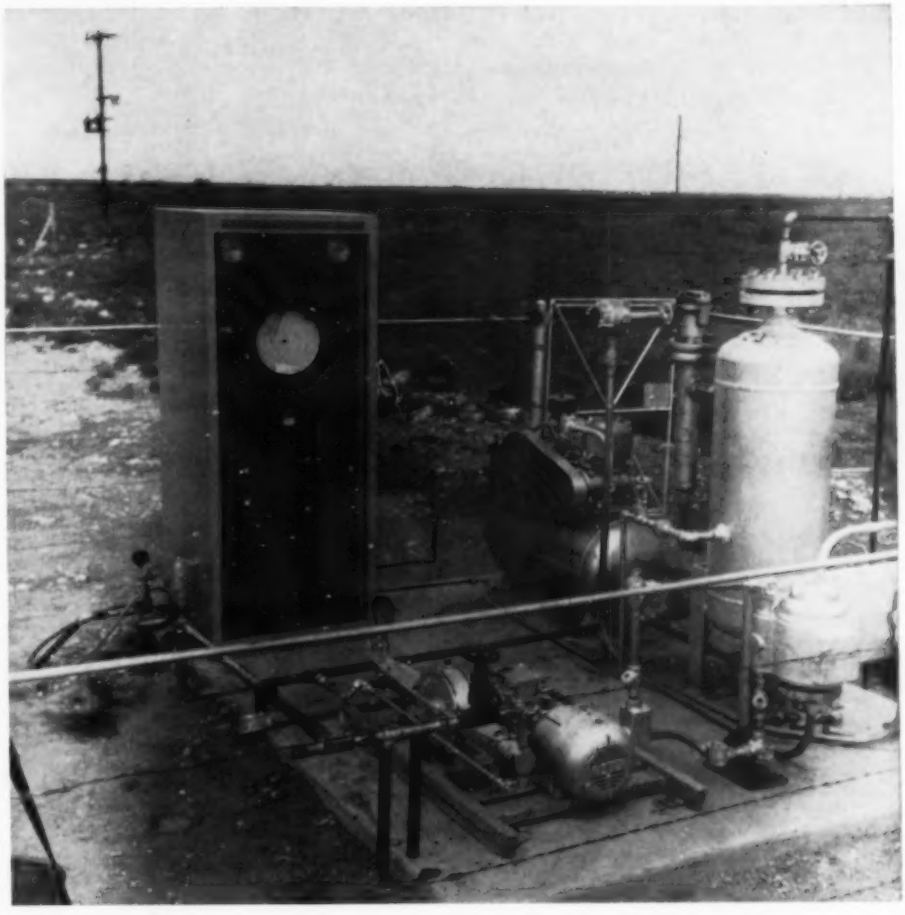

FIGURE 1—Typical field installation of a new vapor pressure recorder-controller. The instrument holds vapor pressure variation to less than one pound despite wide variation of volatile injection volumes.

Injecting Volatiles Into Crude Lines Automatically

A vapor-pressure controller is maintaining proper blends of gasoline products and crudes in cross-country lines

By P. R. Scott, Chemist,
Shell Pipe Line Corp., Houston

A NEWLY DEVELOPED vapor pressure controller is proving successful in regulating the injection rate of volatile products into crude lines for optimum results. This new controller makes it possible to maintain uniform vapor pressures in the line, well within the proper pumping range.

This is an important development because crude lines have been called

Before-and-after charts show variations in vapor pressure . . .

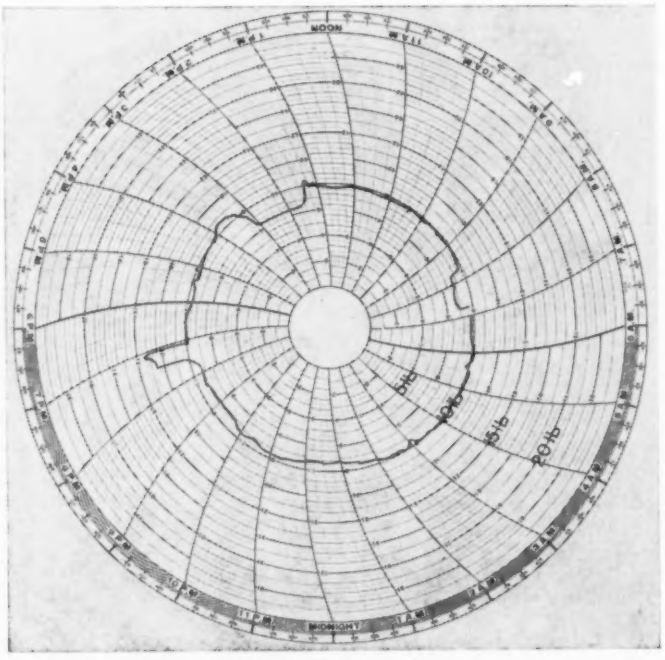

FIGURE 2—Before controller was installed, the vapor pressure varied considerably. Control at this time was achieved through setting the pump rate.

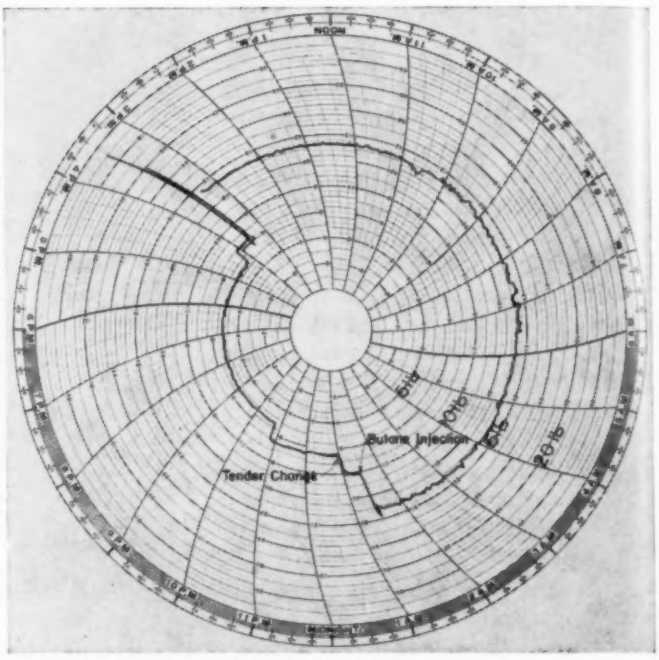

FIGURE 3—After controller was installed there was very little variation in the vapor pressure during the controlled operation as shown on the upper right segments of the chart.

on to accept an increasing amount of high vapor pressure natural gasoline plant products in recent years. Because of the properties of these products and the physical limitations of the crude oil pipe lines, they must be transported as crude-volatile blends.

There is an economic advantage to shipping such products by pipe line; and this, coupled with the increasing volume of gasoline plant products, has caused a substantial rise in field-to-refinery products shipments.

The increased vapor pressure of the crude-volatile blends has on occasions hampered operations of crude oil systems. Loss of revenue has resulted from high evaporation losses and spillage from boiling tanks. Too, it has been necessary to maintain high back pressures to avoid pump cavitation.

Methods of controlling injections. The injection rate of high vapor pressure products into crude lines has been controlled by various methods. *Ratio control* based on known vapor pressures of the volatile and the crude in conjunction with testing of the blend vapor pressure has been used for some years. This method, however, can be used successfully only where equipment and qualified personnel are available on a 24 hour per day basis. This is not the case at remotely operated stations or in the field. *Control by a prearranged volatile pumping rate* has also been used, but not satisfactorily, since high vapor pressure slugs or often formed. Setting the pumping rate at a conservative value helps eliminate this problem but does not allow the maximum use of the line for transporting volatiles.

Problems Related to Injection of Volatiles. Engineers made a lengthy study of the injection of high vapor pressure products into a system of crude lines extending from New Mexico to the St. Louis area. Volatile-laden crude tenders in this system consist of blends of up to seven different crudes with as many as seven different natural gasoline plant products. These products include natural gasolines and butane. The Reid vapor pressures of the crudes vary from 4 to 7 pounds while the Reid vapor pressures of the volatiles vary from approximately 13.5 to 65.0 pounds.

Problems. The increased gasoline injection into the system brought the usual high vapor pressure problems: *high evaporation losses, boiling within tanks, and vapor locking.* Following a study of the injection procedures, pumping rates for each injection point were set well below the calculated tolerable maximum, and the injection times were lengthened in order to maintain the volume of gasoline products injected per day. Operations were substantially improved; however, even after years of experience, they are not entirely satisfactory.

Slugs. One of the major problems inherent in the transportation of volatiles in crude streams is the occurrence of high vapor pressure slugs of 5 to 30 minute duration. The primary causes are unscheduled stoppages or significant decreases in the flow rates of the crude stream while volatile injections continue. The resulting high vapor pressure slugs may cause boiling

within tanks, vapor locking, pump cavitation and other problems associated with high vapor pressure. A ratio controller located at each injection point can eliminate this problem. But it will not eliminate certain other problems, nor will it permit maximum utilization of the crude line since the controller must be preset to conservative values.

Other causes of slugs. High vapor pressure slugs were also caused by the additive effects of two or more volatile injections into the same portion of the crude tender. In other cases it was found that the gasoline plant pumping rates had been set too high as the result of calculations based on incorrect vapor pressure values for the crudes or volatiles.

Solution to problems. The requirements of an instrument that will effectively eliminate all of the problems are simple. It must continuously monitor the stream vapor pressure and control the volatile injection rate to maintain the vapor pressure at a set value. Fig. 2 points up these requirements. It shows the variation in vapor pressure of crude-volatiles blends when the volatile injection is not controlled, but set only by the volatile pumping rate.

Crude-Volatile System. A simplified flow diagram of a volatile-crude system is shown in Fig. 4. Volatile-laden crudes occupy approximately 100 percent of the available space in Segment I, 30 to 40 percent of the available space in Segment II, and approximately 55 percent of the available space in Segment III.

Four volatile injections in the first segment of the system brings the Reid vapor pressure of the crude-volatile blends to about 10 pounds during the winter months and the volatile content to as much as nine percent volume.

Gasoline plant products are injected into the volatile-laden crudes at two locations on Segment II of the system. The injection of relatively large amounts of butane, Reid vapor pressure of 65 pounds, at the first location is of primary interest. A vapor pressure recorder-controller was installed here to record the vapor pressure of the crude-butane blend and to indirectly control the butane injection. The injection of a gasoline, having a Reid vapor pressure of 32 pounds, at the second location increases the volatile content of some portions of the tenders to 12 percent volume or more during the fall and winter months. A vapor pressure recorder-controller at the second location limits the volatile injection rate only when the vapor pressure of the main stream exceeds a preset value; otherwise, the injection is controlled by other means. Farther downstream a vapor pressure recorder-controller can be utilized to increase the injection rate of a low vapor pressure crude if the main stream vapor pressure exceeds the maximum permissible value.

Portions of the volatile-laden tenders go into tankage at two stations on Segment II of the system. Normally the major portion is "tight-lined" from one end of Segment II to the other. The same portion of a tender does not necessarily go into storage at both locations.

The volatile-laden tenders ordinarily go into storage at the end of Segment II, at times these tenders go directly to Segment III.

Installation of Experimental Vapor Pressure Controller. Control of the butane injection in Segment II alone was not sufficient to permit maximum utilization with safety because of the 32 lb. gasoline injection downstream. Irrespective of this, the butane injection on Segment II of the system offered ideal conditions for evaluating the experimental model of the vapor pressure recorder-controller. Here, an unlimited supply of butane and adequate pump capacity gave reasonable assurance that a sufficient quantity of butane could be injected to raise the vapor pressure of the lowest vapor pressure crude to the highest desired value. Equally important was the fact that the volatile-laden tender passing this point would vary in vapor pressure from 4 to 12 pounds.

Butane was injected into the side of the 20-inch line through a four-inch connection. An air-to-open pneumatic valve operated by the vapor pressure recorder-controller was installed in the 4-inch line about 60 feet from the injection point. A ¼-inch sample tap was made in the top of the crude line 25 feet downstream from the injection point. To reduce the time lag, small volume piping was installed to supply the slip stream to the instrument. The total time required for a small quantity of the blend to travel from the injection point to the sensing element within the vapor pressure instrument was calculated to be 20 to 25 seconds. Figure 1 is a photograph of this instrument at this location.

Calibrating and Testing the Experimental Instrument. Tests were made to determine the elapsed time between the opening of a plug valve on the injection line and a vapor pressure change indicated by the instrument. It varied from 18 to 25 seconds.

A direct calibration of the instrument was made in the field. A sample tap was installed on the line supplying the instrument. Reid vapor pressure samples were taken at this point directly into the sample container of the Reid apparatus while maintaining conditions to obtain a representative sample. The instrument reading was recorded at the same time the sample was taken. This value was then compared with the Reid vapor pressure value for the sample determined in accordance with ASTM-D323-56. A calibration curve was then drawn from data accumulated for various vapor pressure crudes (Figure 5).

Vapor pressure values for samples taken from the instrument supply line were compared with values for samples taken 7.15 miles downstream to establish whether the sample line was properly located. Agreement of the vapor pressures for samples taken at the two points from the same portion of a blend indicated the sample stream represented a homogenous blend of the crude and butane when the butane was less than 2.7 percent volume. At higher percentages of butane, the vapor pressure of the sample stream was too high. The limited data available indicate that the difference increased in a linear manner from zero for 2.5 percent butane blends to 2.1 pounds for 6.9 percent butane blends. The sample tap was later moved and is now located 45 feet downstream from the blending point and 45° below top center.

Tests conducted some time ago indicate that for one instrument this placement of the sample outlet tap is satisfactory up to 5 percent volatile blends while for another instrument it is not. Mixing nozzles equally

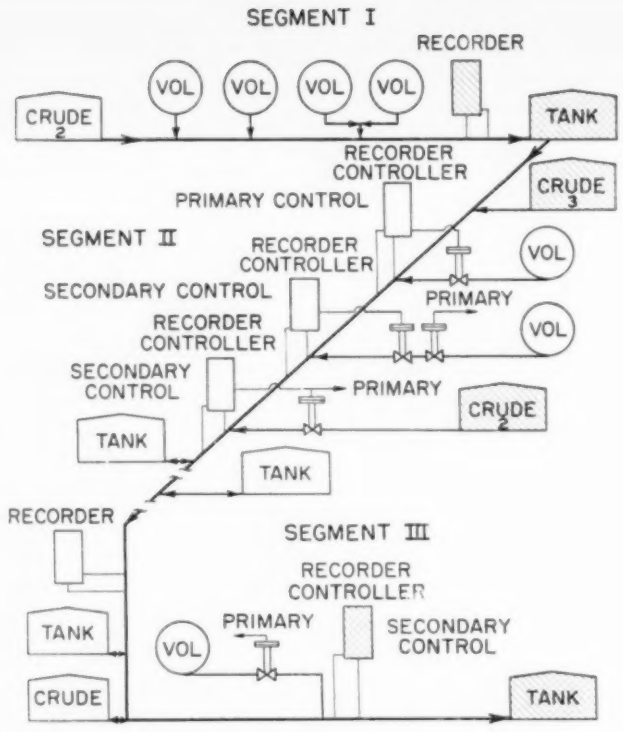

FIGURE 4—Flow diagram of Segments I, II and III of a pipe line system transporting volatile-laden crude from New Mexico to St. Louis.

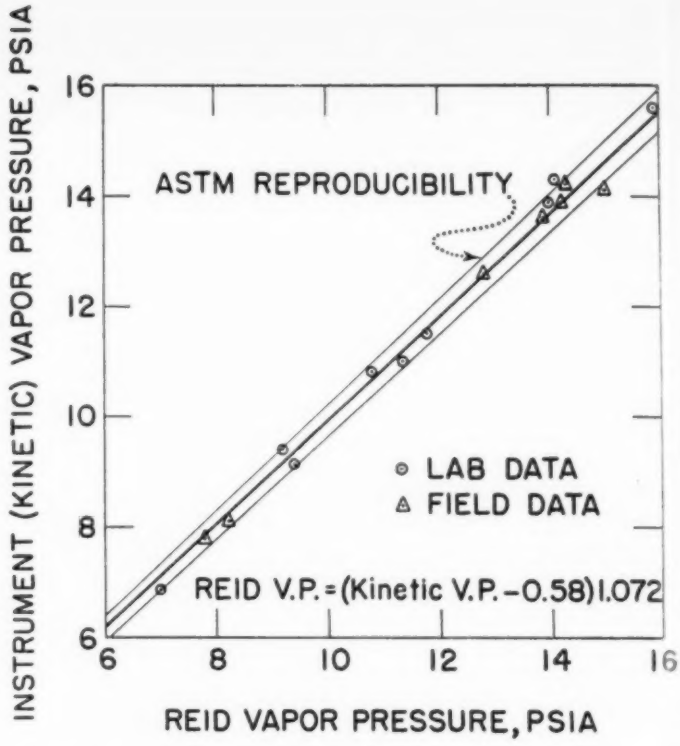

FIGURE 5—Reid vapor pressure vs. instrument vapor pressure. Correlation was established between readings and Reid vapor pressure from data accumulated for various vapor pressure crudes.

spaced around the main line are recommended and should be installed at future installations provided no other fittings are in the crude line to increase mixing.

Determining Safe Vapor Pressure Limits. To realize maximum utilization of the various crudes comprising the volatile laden tenders for transporting the volatiles injected in Segment II, it was necessary to establish maximum permissible vapor pressure limits and to control the injection of the gasoline and butane to maintain these limits.

A thorough study of the shipment of a high vapor pressure volatile tender (Reid vapor pressure of 15.8 pounds) was made. It was concluded from this study and from later operating experience that crude having a Reid vapor pressure of 16.0 pounds could be transported without any unusual operating problems provided; *(1) that line and tank temperature are 80° F or below (2) that the atmospheric pressure at breakout tankage exceeds 13.5 pounds absolute, and (3) that floating roof storage tanks are used.* These findings are consistent with those reported in API Bulletin 2513.

Operating Experience—Experimental Instrument. The field installation of the experimental vapor pressure recorder-controller was completed some time ago. The instrument has satisfactorily controlled the injection of the butane to maintain the Reid vapor pressure of the crude-volatile blend within ± 0.3 pound of the selected vapor pressure. The pumping facilities at the gasoline plant were not satisfactory during the initial testing period since the pressure on the butane line could not be kept constant. Because of the pump arrangement the pressure at the control valve varied by as much as one hundred pounds when the injection rate changed. Despite this radical pressure variation the instrument controlled the injection to maintain a uniform vapor pressure blend.

Figure 3 shows 24 hour record taken from the vapor pressure recorder controller. At 3:30 p.m. of one day the vapor pressure recorder was tested and put on stream. The index was set at 14 pounds. The instrument recorded the vapor pressure of the passing stream until approximately 1:30 a.m. of the next day. Then the block valve on the injection line was opened and the pumps at the gasoline plant were started. The instrument controlled the butane injection rate to maintain the desired vapor pressure in the crude line. The data for this 24-hour run are given in Table 1.

About the Author

Paul R. Scott is a chemist in Shell Pipe Line's Technical Development Laboratory in Houston. He graduated from the University of Houston in 1949 and after working two years in a commercial testing laboratory, he joined Shell Oil Company as a chemist at the company's Deer Park refinery. Most of his time was devoted to product formulation and quality control. He joined Shell Pipe Line in 1956.

TABLE 1—Butane Injection

TIME	Average Injection Rate, BPH
1:25— 2:30 a.m.	253
2:30— 4:30 a.m.	302
4:30— 6:30 a.m.	148
6:30— 8:30 a.m.	240
8:30—10:30 a.m.	253
10:30—12:30 a.m.	301
12:30— 2:30 p.m.	262
Average to 3:45 p.m.	252
Calculated Average Based on Vapor Pressure of Various Crudes and Butane	260
Crude Flow Rate, BPH	9350

The instrument's operation improved and the vapor pressure variation was reduced to less than ± 0.3 pound after the pumping arrangement was revised and the pressure control system was improved at the gasoline pump station.

Once the control became available, the shipper requested that each tender designated for carrying volatiles be blended to the same vapor pressure. A vapor pressure setting was calculated using the vapor pressures of the various crudes comprising these tenders, the average volume of crude available per day, the average vapor pressure of the butane, and the desired butane shipping rate. The vapor pressure recorder-controller was then set at the calculated value. The instrument controlled the butane injection rate to give a uniform vapor pressure blend and kept the average injection rate within 3 percent of the desired value. During this time the injection rate varied from 140 bph to 550 bph because the vapor pressure of the crudes passing the blending point changed.

Based on the operating experience gained from this instrument, it was determined that the principle of operation employed was sound and that similar instruments could be used at numerous locations to monitor and control vapor pressure of various hydrocarbon streams.

Recent Operating Experience. The original experimental vapor pressure recorder-controller has been replaced and three others installed on Segments II and III. A vapor pressure recorder of the same basic design was also installed to record the vapor pressure values for crudes transported through the first segment of the system. It is necessary to know the vapor pressure of the crude from Segment I to calculate the maximum amount of butane and gasoline that can be injected into Segment II if the vapor pressure recorder-controllers are inoperative.

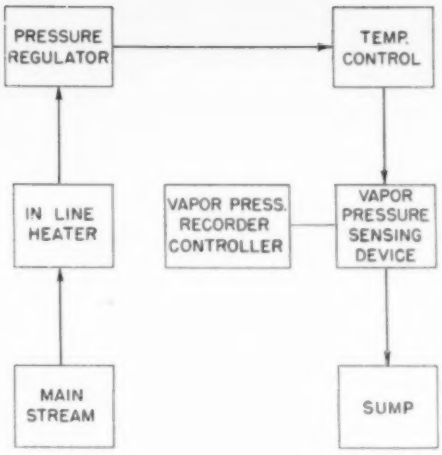

FIGURE 6—Schematic flow diagram of sample going through the vapor-pressure recorder controller. Heart of the device is the specially designed ejector in the instrument.

After the normal start-up period, the instruments controlled satisfactorily and on occasions acted to prevent high vapor pressure slugs. **Approximately 45,000 more barrels of butane were shipped by the crude system during the months of October and November than could be expected from past experience. This increase was attributable to the control of vapor pressure and higher vapor pressure limits.**

How The Instrument Works. An especially designed ejector shown in block form in the flow diagram is the heart of the vapor pressure recorder-controller. This device measures 1 by 2½ inches. All other components are present to maintain the proper flow conditions, record the ejector pressures, interpret them, and re-establish this pressure should it deviate from the desired value.

The first function of the instrument is to heat a sample of a well mixed crude-volatile stream in an in-line heater. A pressure regulator immediately downstream then reduces the pressure to a value which allows the vapor pressure sensing device to function properly. The temperature control sensing element located adjacent to the sensing device maintains the sample stream at the proper temperature by regulating the in-line heater through a feed-back system. The Kinetic vapor pressure of the stream is determined by the vapor pressure sensing device and transmitted to the recorder-controller. After passing through the sensing device the sample stream goes to a sump.

The vapor pressure recorded by the instrument is neither the true nor the Reid vapor pressure. A linear correlation does exist, however, between the vapor pressure recorded by the instrument at specific operating conditions and the Reid vapor pressure of the sample stream. The reproducibility for Reid and instrument vapor pressure values was found to be as good as the reproducibility for two operators using different Reid equipment. The vapor pressure recorded by the instrument is called the Kinetic vapor pressure since the ejector device works on the well known principle of increasing the kinetic head until the static head at the nozzle discharge reaches the vapor pressure of the liquid.

The instrument's safety system was designed to afford maximum protection to the line receiving the high vapor pressure products as well as to protect the instrument in case of abnormal operating conditions. If the flow conditions through the instrument are such that its reading is not reliable, or if a power failure occurs, the control valve on the volatile line is closed. When the flow in the main line stops, abnormally high vapor pressure blends are formed at the injection point and the instrument closes the injection valve.

Performance Record. The instrument will control the volatile injection at a determined optimum rate. This allows maximum utilization of crude pipe lines for transporting high vapor pressure products. As a result, the pipe line operator benefits from the increased volume, shippers reduce transportation costs, and the refiner receives uniform vapor pressure blends which help smooth refinery operations. The performance of the recorder-controller suggests that it is usable to control the blending, separating and detecting of many streams where the vapor pressure is a dependent variable.

ACKNOWLEDGMENT

From a paper presented at the ASME Engineering Conference, New Orleans, Sept. 19-21, 1960.

The author wishes to acknowledge the contributions of many Shell Pipe Line Corporation personnel, especially those of C. H. Goodnight. Special appreciation is extended to the personnel of the Texas Pipe Line Company whose cooperation and aid made some of the field studies possible.

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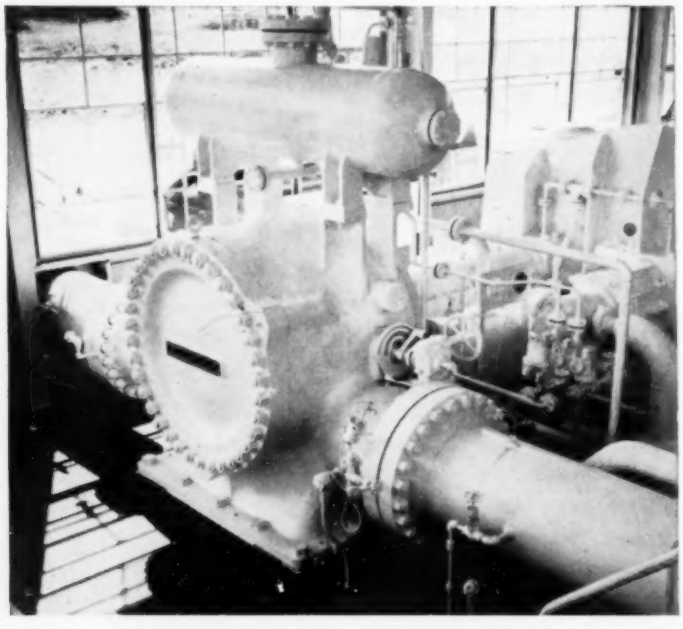

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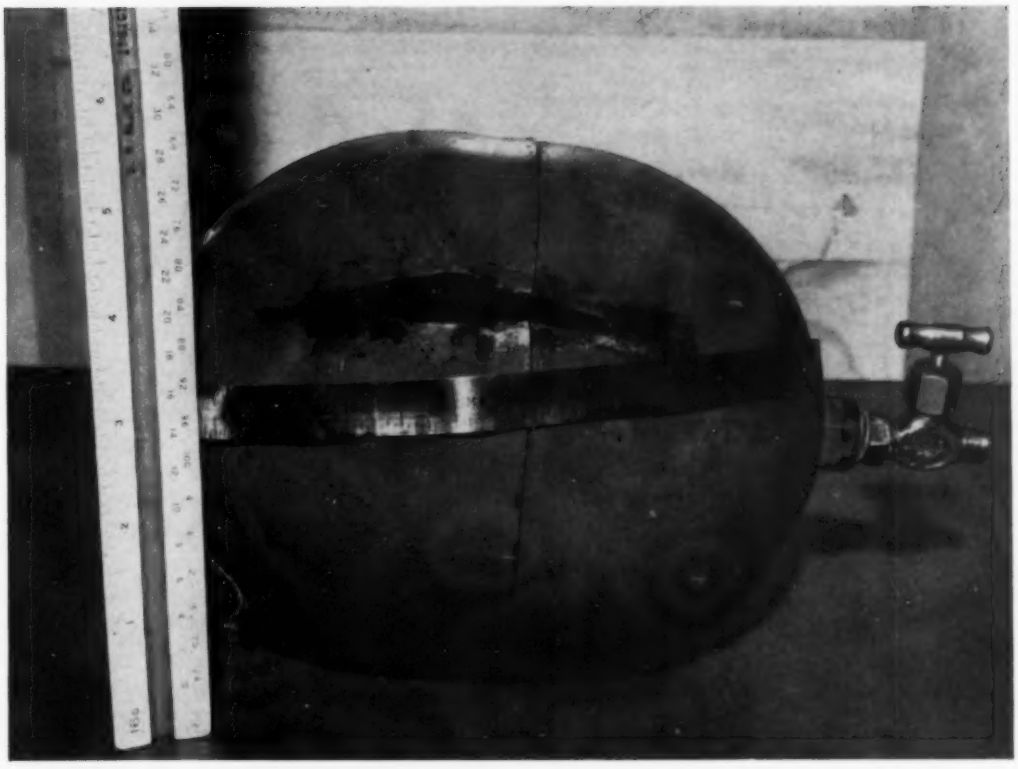

Bomb Ruptured and Flashed. Thermal expansion of the liquid resulting from 49° F temperature rise could have subjected the bomb to 1,000 psig pressure—possibly higher.

Sample Bombs Can Be Bombs!

After reading this case history, you may want to review your own procedures and equipment for sampling light hydrocarbon mixtures

By **J. C. Ducommun**
Standard Oil Company (Indiana)
Chicago

BOMBS FOR SAMPLING light hydrocarbon liquids can be as dangerous as their name implies. This was demonstrated recently at the Mandan, N. D., refinery of Standard Oil Company (Indiana).

A bomb of 1,900 ml. capacity ruptured, releasing butane vapors, which flashed. Fortunately, no one was injured, but the potential was extremely serious. We are reporting this accident because similar accidents may occur in the petroleum, natural gas and chemical industries unless proper precautions are taken.

The bomb involved was an Air Force surplus 1,900 ml. capacity oxygen container, thought to be stainless steel, but later found to be low carbon steel. The design pressure rating was 500 psi, and the working pressure rating was 400 psi.

The bomb was being used as a sample container for field butane. Before delivering the bomb to the alkylation unit, the laboratory had introduced into it about 30 ml. of dry ethylene glycol. An alkylation operator, experienced in sampling field butane, filled the bomb with field butane at a line pressure of 220 psi at a temperature of 26° F, so that water content could be sampled in the laboratory.

Bomb Ruptures. At the refinery laboratory, the bomb was placed in a shaker to thoroughly mix the ethylene

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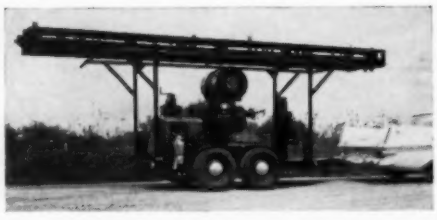

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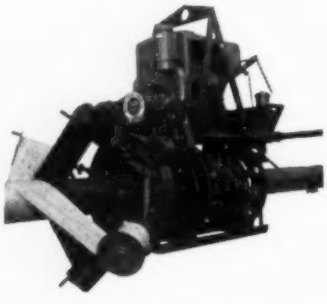

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glycol with the butane sample absorbing moisture from the butane. During the shaking, the bomb ruptured (see photo), releasing the contents which vaporized rapidly and flashed at a furnace in which carbon was being burned from a sample of cracking catalyst.

Three persons were in the laboratory when the butane flashed. The fire was extinguished within a minute with carbon dioxide extinguishers thus the damage was minor, confined primarily to a scorched ceiling, broken windows, and bulged fresh air ducts.

The bomb ruptured along longitudinal planes, as you would expect if failure was caused simply by overpressure. No major divergency in the path of the fracture was apparent. Micrometer measurements showed that the wall thickness of the metal shell ranged from 0.031 inch to 0.040 inch. Rupture occurred through the thinnest portions of the hemispherical components, and although there was some local expansion of the metal shell, the expansion did not appear to be attributable primarily to the variation in wall thickness.

Metallographic examination revealed that the bomb had failed in a ductile manner, by the shear mode of fracture. The base material consisted of low carbon steel that appeared to be of normal quality. The two hemispherical components were joined with a copper-base brazing alloy. The brazed joint was sound.

Metal Yield. Calculations based on butane as the contained liquid, indicated that up to the yield point of the low carbon steel, the pressure on the metal shell would increase about 38 psi for each 1° F rise in temperature. We then estimated that the base metal would start to yield at a pressure of about 550 psig. Once the base metal did start to yield, subsequent unit pressure increase per 1° F rise in temperature would have been less than 38 psi.

The bomb had been filled with field butane at a temperature of about 26° F and a line pressure of about 220 psig. Under these conditions, the bomb could have been liquid full with any contained air dissolved in the butane. After being brought into the laboratory and warmed to room temperature of 75° F, the liquid expanded. It appears, therefore, that the thermal expansion of the liquid, resulting from the 49° F temperature rise, could have subjected the bomb to a pressure of at least 1,000 psig, and possibly to even higher pressures if bursting had not occurred.

Overlooked. We concluded that the operator who had taken the field butane sample had probably failed to vent the bomb after filling it. The regular sampling procedure requires venting to assure a vapor space in the container. Although the operator was aware of this and customarily vented similar samples, he admitted that he might have overlooked venting of this particular sample.

Butane samples are vented in the laboratory before being shaken prior to testing. This sample was one of a number which had arrived in a group and it may have been overlooked.

A committee appointed to make a complete study of the subject of sample bombs for high pressure liquid hydrocarbons, is considering, among other things, the following:

1. Standardizing use of 75 and 150 ml. bombs manufactured of monel. Pressure rating of these bombs would be 5,000 psi.
2. Visual inspection of bombs whenever valves are changed, plus pressure testing to 8,000 psi every five years.
3. Requiring specific approval for larger bombs which are to meet these specifications, limiting the maximum size to 300 ml.
4. Tagging each bomb, giving serial number, volume, tare weight, and date for next pressure test.
5. Permitting only trained personnel to take samples of high pressure liquid hydrocarbons.
6. Requiring sufficient outage for all samples taken.
7. Closing the open end of each valve with cap or plug immediately after bomb has been filled and vented to prevent escape of gas if valve fails.
8. Providing carriers for transportation of bombs.
9. Checking all bombs for leaks when brought to laboratory and placing them immediately in a freezer at 20° F. Discarding sample if bomb leaks.
10. Checking outage of each bomb by weighing before distributing for analysis.
11. Keeping bombs in hoods while awaiting analysis or pickup for discard.
12. Providing daily pickup of

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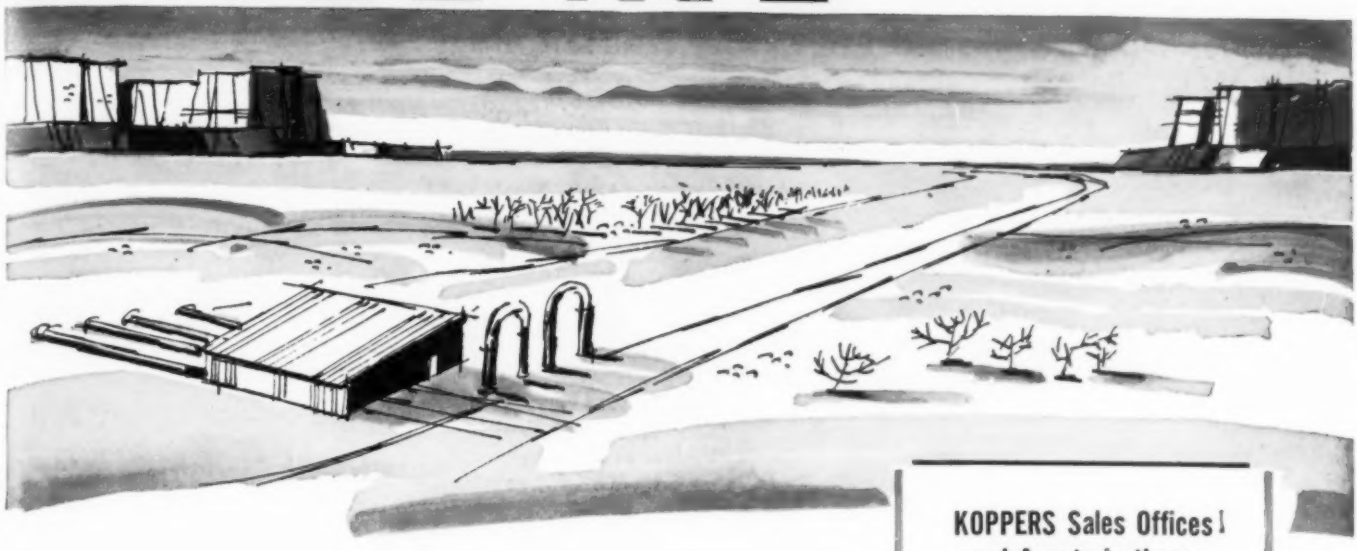

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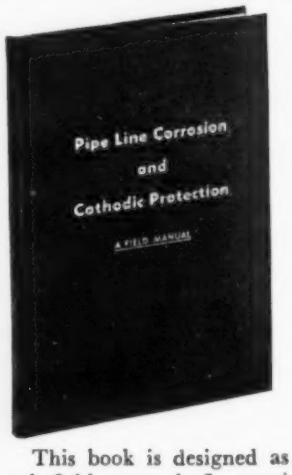

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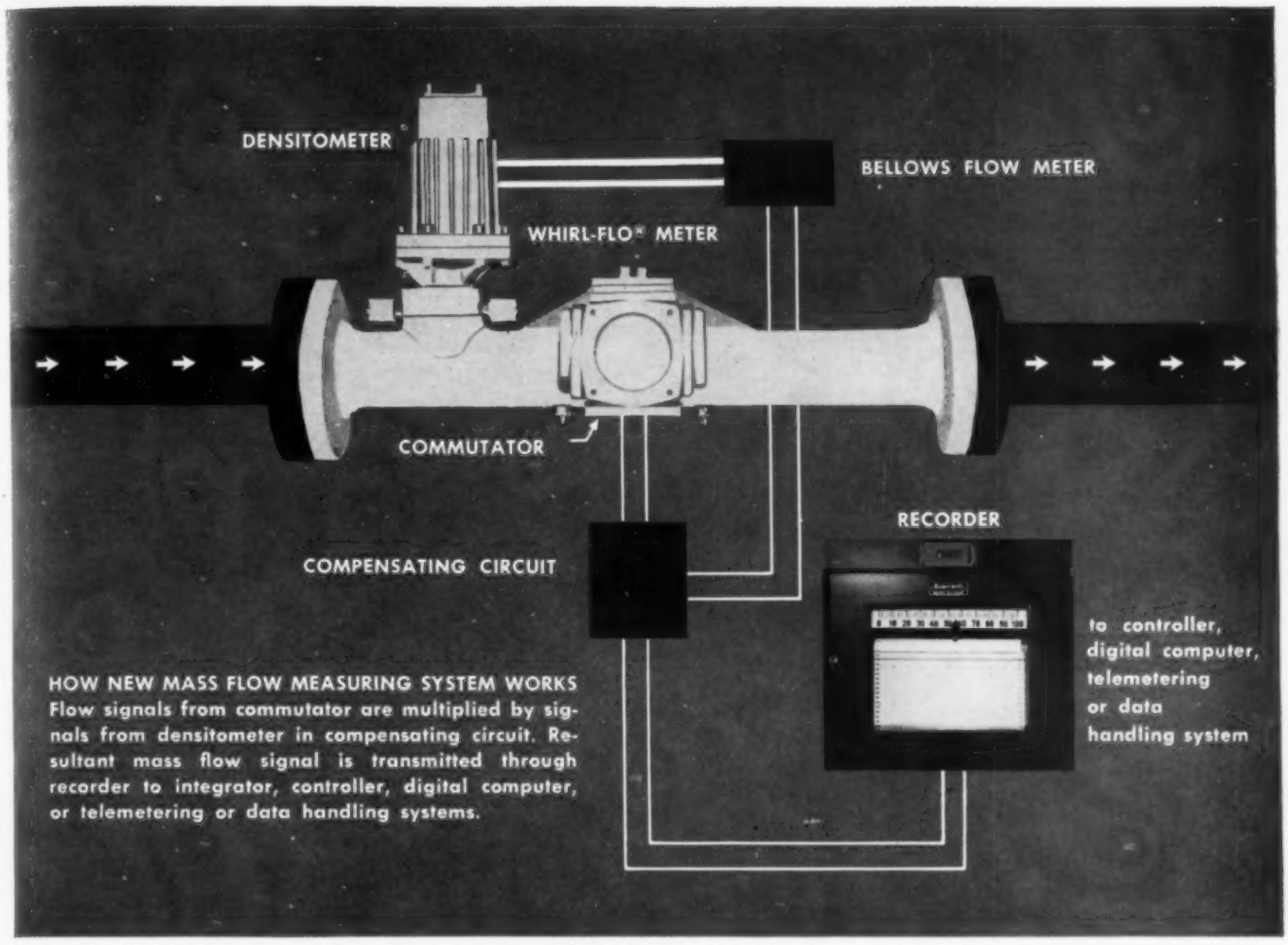
About the Author

J. C. Ducommun is general manager of manufacturing for Standard Oil Co. (Indiana). He received a B.A. degree from Morningside College, Sioux City, Iowa, then went to the University of Iowa where he received a B.S., M.S. and professional engineering degrees in civil engineering. In 1927 he was appointed research assistant in the department of hydraulics at the University of Iowa where he served for one year. He joined Standard Oil Co. (Indiana) in 1929 as a design engineer in the engineering department at the Whiting refinery, and in 1932 he organized the Engineering Inspection Department. In 1934 he became assistant general foreman of the Pressure Still Department and three years later was made general foreman of that department. He became assistant superintendent of the Light Oils Division in 1943 and one year later was made assistant general superintendent of the refinery. He was advanced to manager of the Whiting refinery in 1948. In October 1952 Ducommun was promoted to assistant general manager of manufacturing at the company's general offices in Chicago, and four years later was promoted to his present position and elected a director of the company. He is also a director of Calumet Nitrogen Products Co.

bombs containing samples which have been analyzed.

13. Discarding sample through a steam vent. Access to the vent shall be in a fume hood.
14. Marking and delivering to the sampling technician for valve removal, all bombs with inoperative valves. This work must be performed in a hood and extreme care used to guard against the possible sudden release of trapped hydrocarbons.

We intend to inform the industry of our conclusions when our studies have been completed. In the meantime, these contemplated precautions may be of value to the industry by stimulating a review of practices and equipment design. —The End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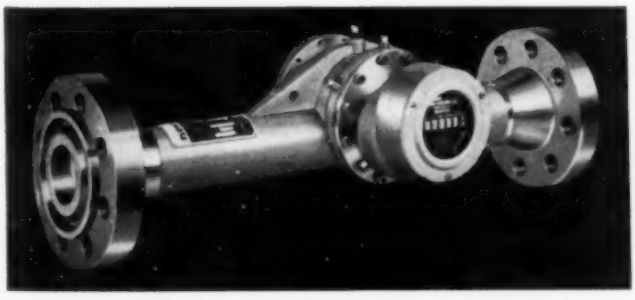

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How to Get Along In Latin America

Good public relations is vital to both you and your organization. Here are a few tips which will enable you to interpret Latin America with a Latin American view

By Thomas Garcia-Borras
Texas City, Texas

U.S. INVESTMENTS south of the border are one-third of the total investments abroad; if further solid investments are to be made—and the challenge of European markets is to be met—good public relations or the "let's-be-friends" policy should be cultivated.

Suppose a Frenchman visiting this country asks you, "Is Mr. Hoover still your president?" You will probably think the visitor either had a few drinks or was pulling your leg. Yet that is the type of questions Americans often ask in Latin America. Of course, these questions certainly do not make friends, since they show a lack of interest in the country.

How then, should you conduct yourself in Latin America in order to get along with its people? Here are a few tips described with examples based on my experience in the Mexican chemical industry as well as in this country. They deal only with public relations, however, not how to conduct business.

A Sleeping Giant. Phillips, Shell, Socony Mobil and RCA are familiar companies with business south of the border that amount to one-third of the total U.S. investments abroad (*Fortune,* February 1958). Latin America is two and a half times larger than the United States, with almost 200 million people.

Latin America has long been a sleeping giant, but one which is quickly awakening. However, most of the other countries are "one-crop" countries and semi-colonial in structure. Each country has its own customs, its own national heroes, its own history; but, in one respect they are all alike: they are proud of their own country with a glorious past, a poor present and a promising future for most of them.

Know the language

This is the kind of nationalism not readily understood nor accepted by foreigners. A criticism of their government or their social life will certainly hurt the people's feelings and your business too in the long run. What would be your reaction if a stranger would spank your spoiled child, then lecture you on how to bring up children? You would be disturbed. And Latin Americans do not want foreigners to lecture them either.

Be Informed. In addition to language and religion, Latin American inherited from Europe the "cult of culture." People are deeply concerned about culture for the sake of it. For example, Americans abroad are invited to discuss about radiation fallout or about the foreign policy of the United States in the Middle East. Latins do not mean to bother you. They just take for granted that everybody knows what is going on around.

If you do not know the right answers, let them tell you about their country. Latin people love to talk and you will probably learn something new from them.

Continued on Page 48

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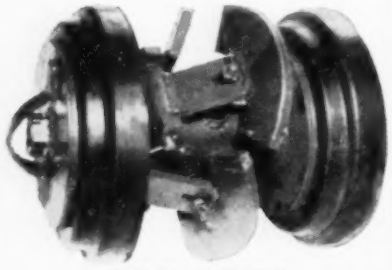

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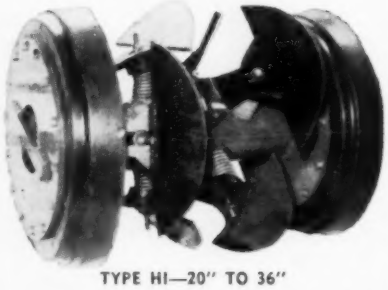

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Resentments in Latin America toward the United States might be summarized by the general feeling that "Latin America is an important friend in war, but forgotten in peace." This is not quite true; but so far, no one has convinced them why this country should be so generous in foreign aid toward European and other countries, including communist Yugoslavia, while the U.S. free enterprise sometimes badly hurts the Latin American economies; the dumping of U.S. cotton abroad is one example.

Developing Good Public Relations. Most people agree that good public relations helps a company progress. Therefore, here are four quick tips which will certainly help you achieve better relations with our Latin neighbors.

Tip 1: Know the Language. It is clear that a German engineering firm would not operate too long in this country if the staff could not speak English. But one important American engineering firm has maintained a staff in Mexico for years yet not one member can talk Spanish. Mainly because of World War II, most foreign investments south of the Rio Grande have been from this country. Now, however, European firms are constantly increasing their share of the market.

Since the basis of communications and understanding is language, to know it is a must. Good public relations—and better business—will be achieved only if foreign firms are, at least, partially staffed with employes knowing either Spanish or Portuguese—whichever applies.

Tip 2: Know the Customs. American tourists know that they have to be acquainted with the country they are visiting to enjoy it better. The staff of American firms will also enjoy the trip and build up a better understanding—and business—if they are familiar with the history and customs of the country. For instance, your wife would be quite out of place if she would go downtown Buenos Aires wearing shorts, and celebration of the National Independence day is a must. Also, south of the border, man is still boss. It is almost unlawful for him to go shopping or do the dishes. Therefore, know the history and customs of the country.

Tip 3: Study the Country. A question can often be embarrassing. A Peruvian would certainly feel uncomfortable if he would be asked whether his country has a university for as we know, the San Marcos University of Lima, founded in 1551, is the oldest in the Americas. Therefore, do not ask questions that show how little you know about them. Study the country first.

Know the customs

Tip 4: Be Socially Active. It is amazing how some basic principles on public relations are forgotten by companies operating abroad. For instance, it is natural that executives and representatives of the company be socially active in the community in this country. But in many instances, this is quite the opposite abroad.

Although we all owe something to the community we live in, in Latin America it is common knowledge that the "socially unknown" are the Americans. However, it is clear that without a knowledge of the language and customs of the country, you can not become socially active. This is why this *tip* was mentioned last. Just remember to try to do as much good abroad as you would in your home town.

Where to Learn. An organized training program for Americans going abroad is probably ideal. Since language is a must, the selected personnel should be familiar with

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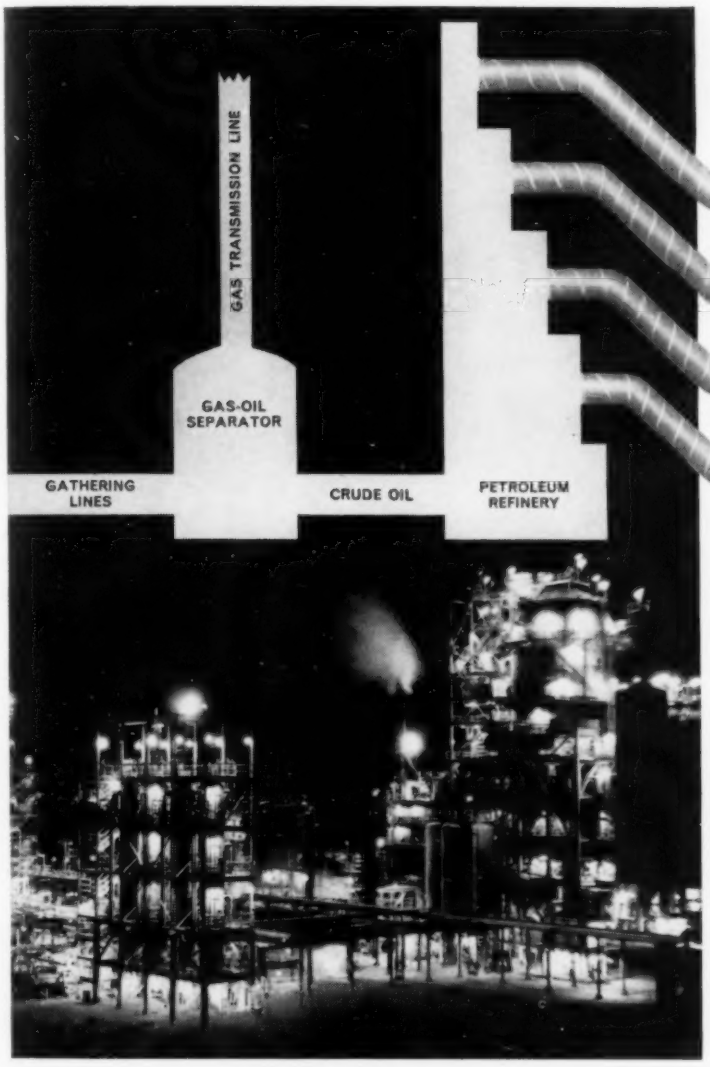

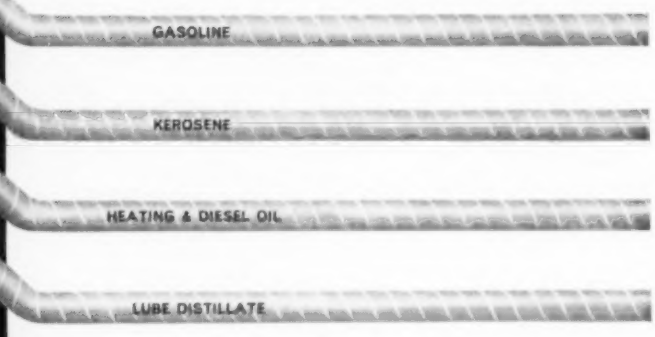

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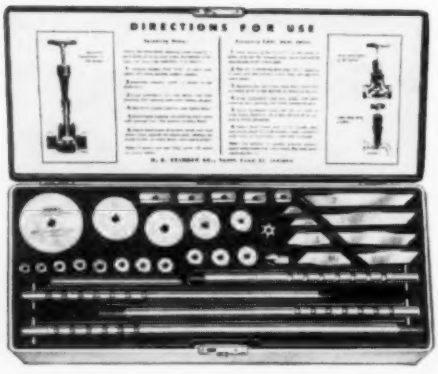

Easily pays for itself on the first two jobs!

Reseats flat and tapered-seat globe or angle valves—all bibbs and faucets—in place, quickly and accurately. The saving, over tearing out and renewing leaky valves and fixtures, is tremendous.

Cutters operating under screw feed, leave worn, scored seats glass-smooth, level, absolutely accurate and tight.

A guide pilot centers each cutter; a tapered cone centers each spindle. Perfect alignment is inevitable. Cutters guaranteed. Write for literature!

2" for ¼" to 2" valves and ¼" to ¾" bibbs
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3" for ¼" to 3" valves and ¼" to ¾" bibbs
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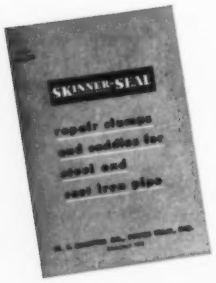

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catalog showing our pipe repair clamps, saddles, and reseating tools

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About the Author

Thomas Garcia-Borras is a research chemist working in research and development. Holder of a chemistry degree from the University of Mexico, he also studied chemical engineering in 1955 at Rice University. Garcia-Borras has seven years experience in various phases of the Mexican chemical industry, and since 1956 has been in the Research Department of a large chemical company in Texas City.

the foreign language. Some should speak it rather fluently.

To help employes going abroad there is an Institute in Phoenix, Ariz., which offers a training program on the language, history and customs of foreign countries. There is also one in New York City which will lecture members of foreign firms on the language and history of Brazil.

In addition, there are several books on Latin America that give the reader a good knowledge about its customs and history, like "Inside Latin America," by John Gunther and "Latin-America: A Modern History," by J. F. Rippy.

Employing Nationals. Finally, many companies have found it is good business to fill positions with as many Latin nationals as possible. In the case of Mexico, in particular, the old legend of lack of qualified technical people is no longer true and if they are well paid, they will be found.

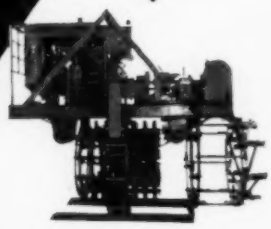
Public relations is a part of any business. With U.S. investments in Latin America growing, public relations in these countries should be improved. Increasing European investments are a new challenge to U.S. firms.

When going to Latin America, you should be genuinely interested in the people and speak their language. Try to interpret Latin America with a Latin-American point of view.

—The End

MYOCO

CLEANING and PRIMING MACHINES

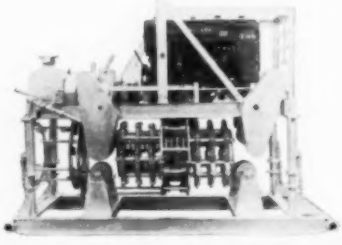


MYOCO MODEL "DR"

Especially designed MYOCO Counter Rotating Heads on this cleaning and priming machine give double cleaning action to pipe.

Seam welds are cleaned thoroughly on both sides.

This fast, dependable unit is powered by an International U-9 self-starting engine using the Ramsey transmission. Engine exhaust is utilized to heat primer tank. Sizes: 3" through 36".



MYOCO CLEANING AND PRIMING MACHINE

Set on a stationary base for yard cleaning this 6-12 Model will clean and prime pipe 3" through 14" diameter plain end.

These machines, like all the equipment at Myoco, can be rented to save you capital, investment and storage costs. Trained, courteous personnel are available 24 hours a day with fast transportation to serve you. Efficient equipment operation is assured by periodical checks. All parts and supplies are shipped the same day, when possible.

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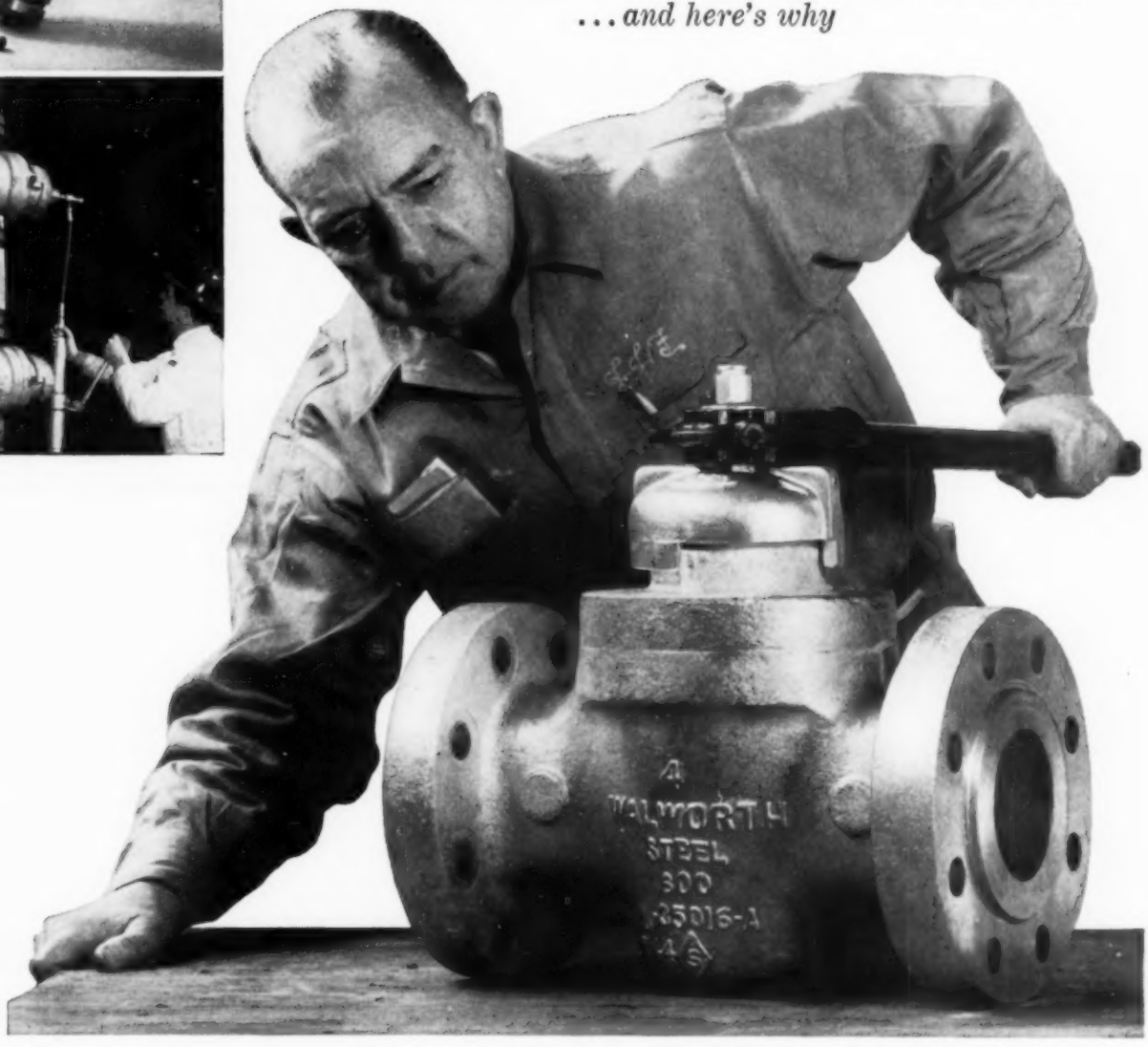

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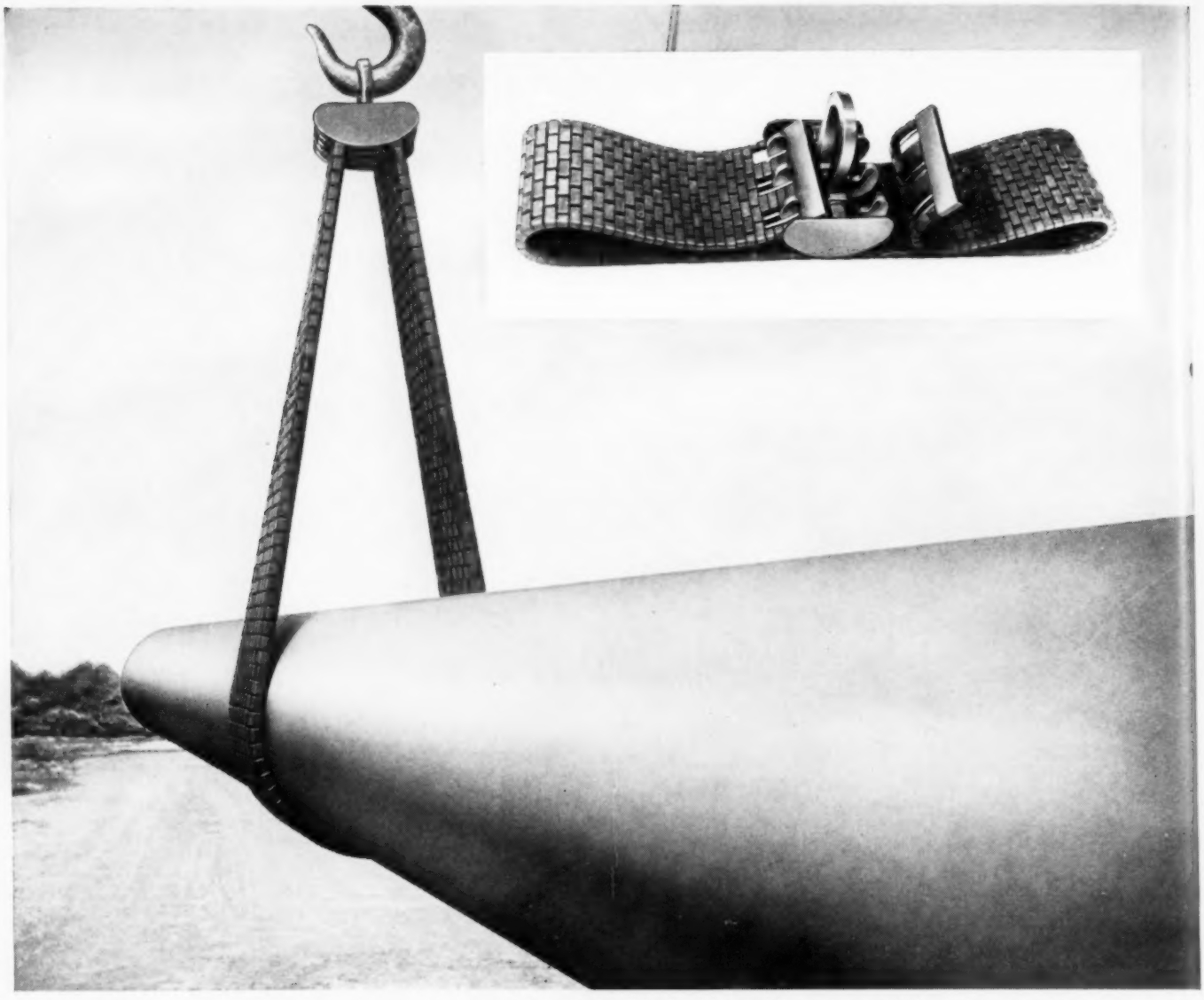

This "Swing Sling", 12" in width, was especially designed for handling pipe and other long cylindrical objects. Because of its wide-bearing surface, one sling will usually be enough to handle a standard section of pipe.

Now...you can handle pipe without surface damage using the new "Swing Sling"*

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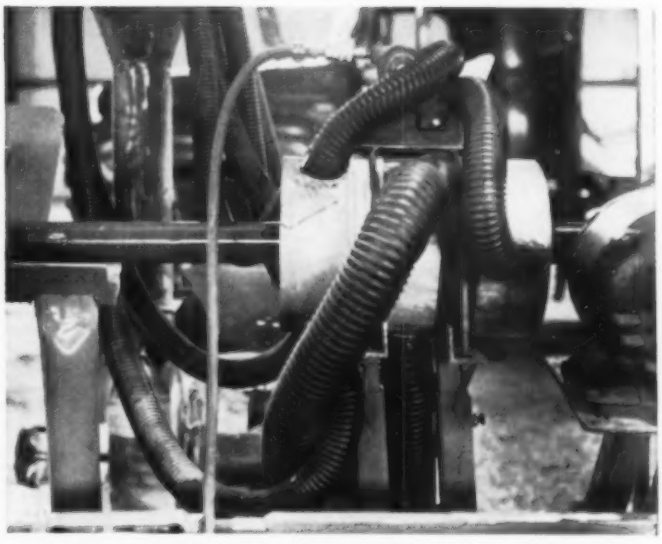
CF&I STEEL

Pipe Line Pete's

IDEAS FOR THE FUTURE!

By **Donald M. Taylor,** Engineering Editor

Pipe passes through furnace and coating machine.



Dry epoxy is "fogged" onto pipe through this applicator.

Epoxy Powder Coating Sprayed Onto Hot Pipe

Pipeliners have long dreamed of a one-shot coating, which could be applied at the mill to furnish both mechanical protection to the pipe surface during shipment and construction and corrosion protection after it has been laid.

The possibility that such a coating may not be long in coming became apparent recently when Tex-Tube, Inc., —a leading manufacturer of thin-wall pipe—displayed a pilot model coating plant for a number of the local pipeliners in Houston. For the most part, these gentry were impressed with what they saw.

The cleaned pipe passes successively through a furnace which elevates its outside surface temperature to a 425 - 450 F range, through a coating head where dry epoxy powder compound is "fogged" onto the hot surface, then through a cooling section and onto conveyors.

The coating material, developed by Minnesota Mining and Manufacturing Co., is thermosetting and cures to a hard, slick finish in a few seconds. What's more, when the temperatures are just right, the coating is both dense and uniform.

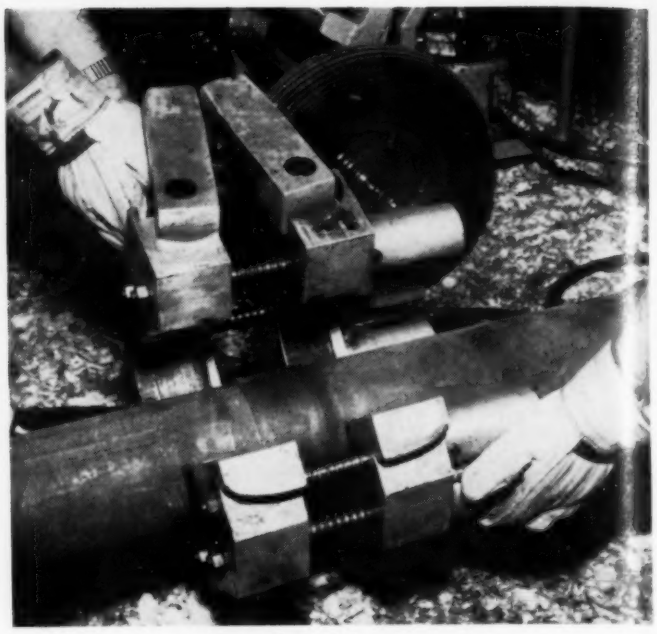
Even as this pilot plant was introducing the process to the Houston pipeliners, two companies had shoved chips into the game and were constructing production coating plants. They are Hill Hubbell and Co. of Cleveland and Pipe Line Service Corp. of Franklin Park, Ill. H. C. Price's Coating Division is experimenting with a pilot plant along with Tex-Tube.

The developers of the process point out that the coating will have a tough battle overcoming conventional coatings. The material costs some $5,000 per ton as compared with $50 per ton for pipe line enamels. But the coating is thinner, requires little labor in its application and, when inspection bugs are shaken out, holidays can be automatically patched in the plant or in the field. What's more, the epoxy coating should not require wrapping. Too, there would be the added advantage of protection during shipment, storage and construction.

Army Develops Insulating Clothing Materials

Using cellular foams may solve the problem of not only surviving, but being comfortable in cold, wet environments, according to a research report just published by the U. S. Army. Closed cell PVC, neoprene and polyurethane were studied for clothing uses. The PVC and neoprene came out best for continuous immersion in water. The polyurethane proved superior in all applications requiring breathability and light weight, but not for continued exposure to water—unless completely shielded.

Glue applied to pipe . . .



pressure applied while epoxy sets . . .

Glue Small Diameter Steel Pipe Lines Together

A rapid, low-cost method of joining small diameter steel line pipe with an epoxy adhesive was demonstrated recently by Tex-Tube, Inc., a Houston pipe manufacturer.

The technique is simple: the plain end of the pipe is coated with the adhesive, thrust inside the flared bell-end of the pipe which is also coated and a patented tool crimps the joint to hold it while the epoxy is setting. (At present, this requires about 24 hours.) The resulting joint has a high efficiency: working pressures are 1,200 psi for 1½ to 3½-inch pipe, 800 psi for 4½ to 6⅝-inch.

The advantages of the new joint are: 1) Where the pipe is coated internally, the break at the weld area is eliminated; 2) the cost is about 25 percent less than conventional methods of joining the pipe and, 3) the time required to make the joint is less than half that required for welded-joint pipe.

finished joint ready for service.

Tests on lines laid by this method have been underway for over a year and a number of field installations have proved highly successful.

These Discoveries May Prove Helpful

New solvent for engine dirt

Perhaps the engine's worst enemies are greasy grime, sludge and varnish. A new chlorinated solvent, propylene dichloride is proving highly effective in removing this. Simply soak the engine part in the solvent, then grease, grime and varnish fall to the bottom as sludge. The solvent can be used over and over.

New super steel has yield of 225,000 psi

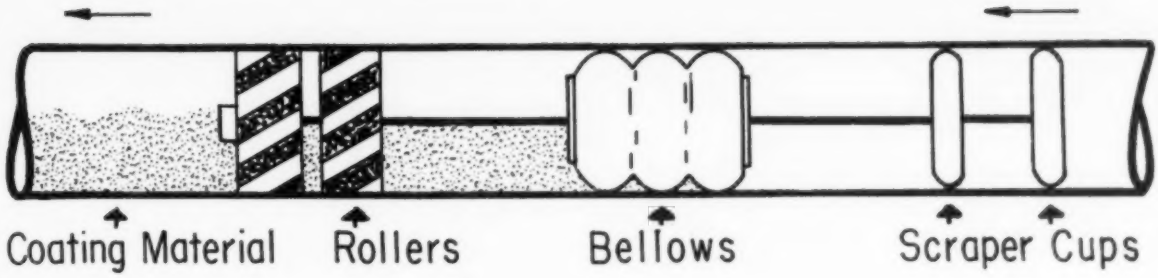
By adding cobalt and limiting silicon in a modification of AISI 4100 series, a new alloy was developed with a yield strength between 225,000 and 235,000 psi. It is being produced for rocket parts by Universal-Cyclops Steel.

New series of glasses

Glass, made of arsenic, sulfur and bromine has a melting point that can be depressed below ordinary room temperatures depending on the precentage of bromine. But once the mixture has frozen it becomes as hard and "glassy" as ordinary glass. Its fractures are typical of glass and its index of refraction runs 1.9 to 2.0. Developer was Bell Telephone Laboratories.

How to get rid of the fire ants

Fill soda straws with peanut butter poisoned with Kepone, cut straw into thirds and distribute six pounds per acre. This method has proved 100 percent successful. Credit for solving this tough problem goes to Alabama Polytechnic Institute scientists.



New Method of Internally Coating Pipe in Place

A "salamander" that travels inside the pipe line and rolls a thin layer of internal coating onto the pipe walls is proving highly successful in tests. Being developed by Mission Manufacturing Co., the new unit apparently has overcome some of the drawbacks usually associated with in-place coating methods: ie. the skips at the top of the pipe and the wasteful deposits on the bottom of the pipe.

To insure an even application of the coating, developers of the "salamander" borrowed upon a principle long used in the printing trade: the best method of applying a thin even coat of liquid to a metal surface is to use rollers. In this case, two or more sets of rollers are rotated as the salamander traverses the pipe. They insure that all of the surfaces of the pipe are coated. Following the rollers a bellows exerts pressure against the pipe walls. This removes excess coating material. Next come the two scraper cups that drive the unit.

The effectiveness of the salamander was demonstrated in a test at Mission's plant test facilities recently. Four gallons of epoxy material was sloshed into a joint of pipe and the device was pulled through the joint with a cable. The rollers and squeegees worked together to apply a two-mil dry film coating uniformly inside the pipe, despite the fact that there was no build up of material ahead of the unit.

The salamander can be run singly or in connection with another plug to enclose the slug of epoxy. Where needed, a combination brake and motive tractor can be spaced ahead of the salamander to insure that the unit does not traverse the pipe at widely varying speeds.

Holes in Wings and Tail May Speed Aircraft

The possibility that paper thin slots cut in the wings and tails of airplanes may increase their speed, range and payload will be investigated for the U. S. Air Force by Northrop Aircraft Corp. says *The Wall Street Journal.*

The theory behind this notion is that the paper thin slots can be hooked into the suction of a compressor to remove a turbulent boundary layer of slow-moving air which now produces most of the drag encountered by the aircraft in flight. For the most part, this turbulent drag area is located in the after portion of the wings and tail.

Pipeliners have experienced a somewhat similar "drag" turbulence inside natural gas pipe lines. What's more, they have partially overcome the effects of this turbulence by coating the inside of pipe with resins which reduce the magnitude of the anchor pattern in the steel. The gain in flow efficiency may run about 10 percent.

Improvements in the Electronics Field

A new thermionic converter which produces electricity from heat will be available this month according to General Electric. The new unit is about the size of a silver dollar, weighs three ounces and produces one watt with a very low efficiency of 2.5 percent. The unit employs a vacuum principle to produce current, having two flat metal plates separated by an evacuated space. When heat is applied to the cathode plate, electrons stream off to the anode plate.

Inefficient as these units are, they still have a number of applications. They will be used to recover waste heat, to utilize solar energy and to serve as a sensing device for heat actuated instruments.

G.E. will continue development work and soon may come out with a cesium vapor unit which will have higher efficiencies.

Faster computer parts

The diode—used widely in computer electronics—has improved so fast there's difficulty in measuring its speed. Bell Telephone Laboratories has developed a tunnel diode which has switched a quarter volt in less time than it takes light to travel 2½ inches! This may mean that computers will be even faster in the future.

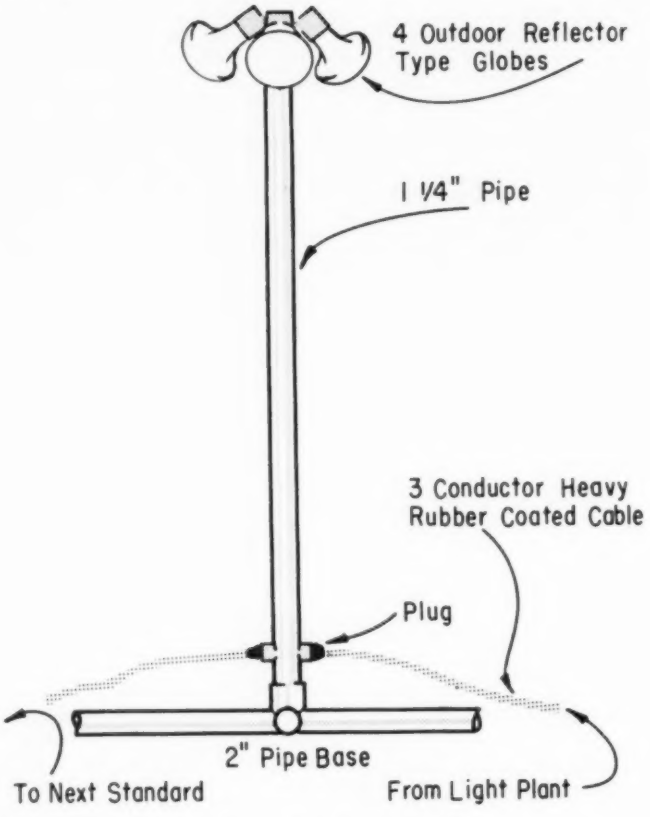
Electron beam vacuum furnace

Space age metals such as tantalum, thorium and molybdenum are hard to melt, and National Research Equipment Corp., has developed a 60,000-watt electron beam that melts stock which has an impressed 20,000-volt attracting force to obtain high-purity ingots. The largest ingot this furnace can make measures 4 by 14 inches.

How to do it

PIPE LINE HINTS

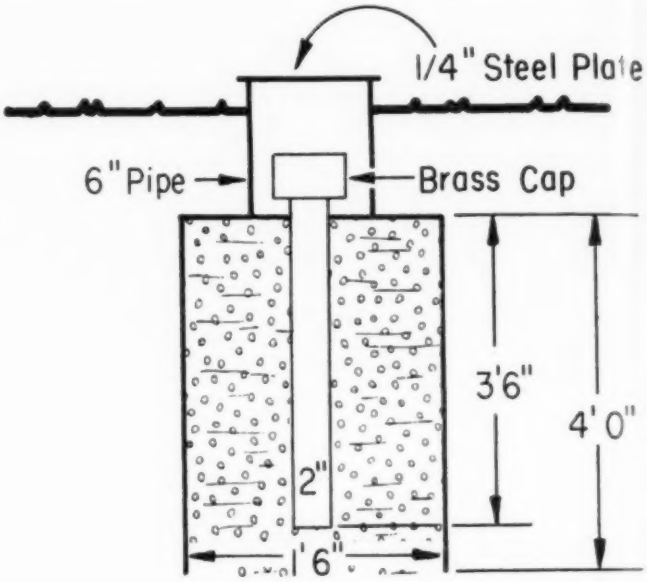
$10 is paid for each illustrated acceptable contribution. Mail to The Editor, PIPE LINE INDUSTRY, P. O. Box 2608, Houston 1, Texas



Light Standards Improve Pipeliners Work at Night

Every now and then it is necessary to continue pipelining despite rain, high water or darkness. In case of the latter, it has been the usual practice to set up a light plant and scatter flood lamps along the right of way. The lighting is not as effective as it can be if it is planned.

The light standards shown here can be constructed of scrap pipe and any sore of electrical fittings that are suitable. Note that the cable does not enter the standard through the base. This simplifies the construction and the setting up as well. During transportation, the standards are disassembled from the bases.



Base Line Monuments Aid in Layout of Station Additions

Construct permanent monuments on a number of base lines before starting station construction and simplify station layout and future station additions. Permanent markers similar to the one shown here should be liberally installed about the job site, preferably in areas not likely to be disturbed by construction equipment.

Concrete for the marker is formed by the earth itself. The 2-inch pipe with its brass cap hand tight is suspended in the concrete at proper elevation and on the base line. Once the concrete has set, the cap is adjusted to proper elevation brazed to the pipe and the point on the base line is scratched on to it. Where two or more of the caps are to be adjusted to proper elevation, move the level at some point equidistant from them to correct for possible instrument errors. The pluses of the base line should be noted on the brass cap.

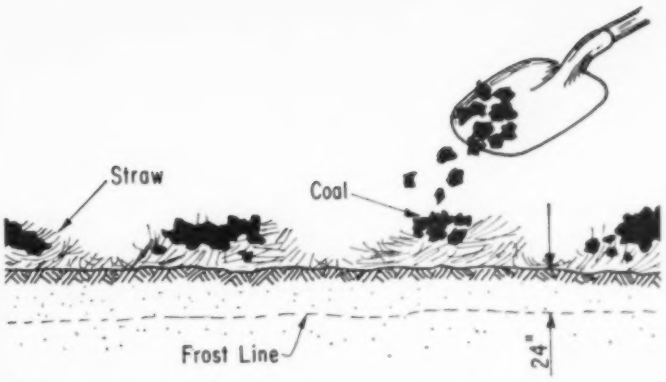
Old Tires Protect Pipe In Stringing Operations

Where the coating on pipe is liable to be damaged or where cast iron pipe is being strung, a couple of old tires will prevent damage as each joint is rolled off of the truck. The tires are chained to the front and back of the truck so as to be dragged along with the truck and be in position to catch the pipe as it is rolled from the trailer bed. When the load is strung, the tires are placed on the truck bed or left at the end of the string to be ready when the next load comes along.

Rubber Padding on Pipe Rack Eliminates Chain Rattling

Carrying small diameter pipe from pipe yard to the jobsite can be a nerve racking job. A chain is effective to keep the pipe on the rack, but sometimes when traveling a long distance the pipe will work loose. Thus, the chain would knot and bang against the truck and become very noisy.

To restore peace and tranquillity, one pipeliner fastened rubber around the pipe rack. The rubber keeps the pipe from slipping and it rides very quietly.

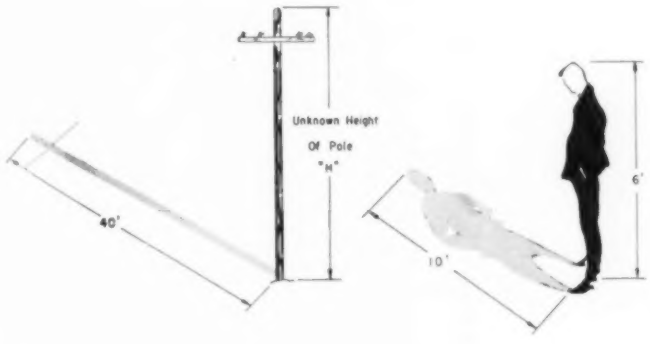


How to Thaw Frozen Earth For Pipe Line Excavation

Now that pipelining is turning northward in an ever increasing tempo, most of us should learn the tricks of the deep freeze country. Here's a method of thawing frozen earth to speed excavation which proves economical in many regions, depending on cost of coal, etc.

If frost has penetrated more than 6 inches below the surface of the ground, excavation is difficult with most equipment. Here is a method of thawing the earth for excavation which has proved highly successful down to 24 inches below grade.

Scatter small heaps of straw along the right of way, each touching the other. On top of these one-foot heaps, place a scoop of slack coal. Next, simply light the straw, and by the time the coal stops smouldering, the ground should be thawed. This method also can be used in pit excavation. Falling snow will not interfere with the melting.

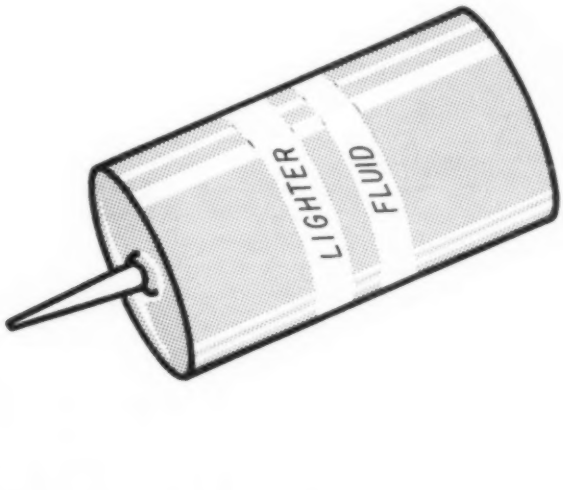


Find Height of Pole Without Climbing it

Sometimes it's very important to obtain an accurate estimate of height. Here's a simple Boy-Scout-like method you can use.

You know your own height, so all you need do is measure the length of your shadow and the length of the pole, tank, etc., shadow. Set up a proportion, and you can get a close estimate of the height.

Say, for example, you are 6-feet tall and your shadow measures 10 feet. If a pole cast a shadow 40-feet long at that time, it will be about 24-feet high (by proportion).



Anti-Freeze Frees Frozen Locks on Meter Stations

This may sound like a tongue twister, but anti-freeze in an oil can or lighter fluid can will free frozen locks with the greatest of ease.

What's the advantage? In extremely cold weather, the locks on meter stations and town border stations have been known to freeze. If you heed this good advice, you'll simply pull out the squirt can of anti-freeze when you are confronted with this situation.

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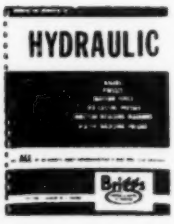

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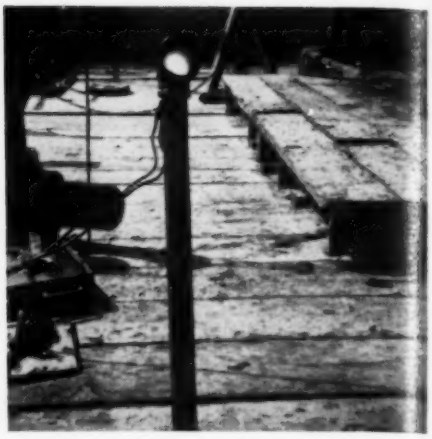


Light Bulb Placed in Pipe Protected from Breakage

A Gulf Coast contractor built this work light using a length of pipe, an elbow, light bulb and a socket. The light can be used for general lighting around the rig or else it can be used for close up work. Because of its design, it is protected from normal breakage.

The light socket is mounted in a hole drilled in the curved portion of the elbow. The elbow is made up loosely on the pipe so that it may be turned in any direction. The pipe is 2½-inches OD and is welded to a base plate. The plate is then securely fastened to the floor.

'Stripe' Cattle Guards For More Night Safety

This Gulf Coast operator has found that it is much easier to spot cattle guards leading into access roads at night when they are "striped" with yellow and black paint. This prevents truck drivers delivering pipe, heavy equipment, etc., from accidently striking the guard and also enables drivers on the night tour to easily spot all entrances.

Telescoped Support Handy For Hauling Pipe on Truck

One Kansas pipe line contractor devised this support on the side of a pickup truck bed to haul short sections

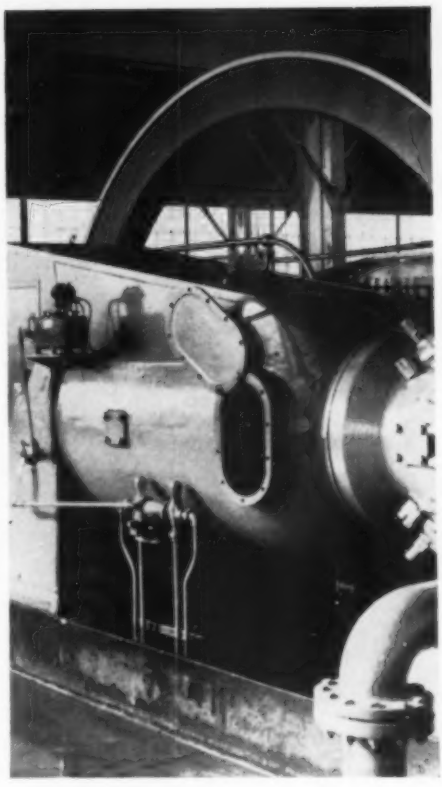
of pipe in the field. It is made by laying a piece of 2½-inch pipe across the front of the bed then placing inside a piece of 2-inch. A piece of rod welded upright on the end holds the pipe joint in place. Matching holes in the racks permit dropping a bolt in to lock the rack in position when the rod is extended.

A brace welded on the inside of the rack keeps the pipe from rolling against the truck cab. By placing a rack on each side of the truck the load will be balanced; the back end of the pipe joint rests across the tail gate of the truck. A vise mounted on the back end of the truck can be used to fasten down one to three joints of pipe when small loads are hauled.

For Constant Inspection Checks, Keep Cover Open

After an overhaul the careful station engineer often hesitates to enclose the crosshead and its bearing. He likes to be able to quickly check its response to new conditions after reassembling.

Here is a good idea from one engineer. He does not remove the cover entirely; instead, all cap screws are removed except the one at the top of the oval opening. This one is loosened enough to allow the plate to be rotated without damaging the gasket, then the plate is swung around and a second screw "locks" the plate open. The cover may be dropped in place simply by removing one fastener.



Rules of Thumb

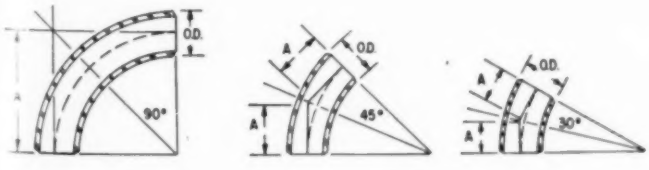
and Engineering Data Sheets for the Pipeliner's field notebook

$25 for Engineering Data Sheet $15 for Rule of Thumb

These practical aids give quick, reasonably accurate answers to design, maintenance and cost estimating problems. PIPE LINE INDUSTRY will pay $25 for each chart, nomograph or data sheet published—$15 for each Rule of Thumb. Send your ideas to PIPE LINE INDUSTRY, P. O. Box 2608, Houston, Texas

Engineering Design —78— **Dimensions of Three-Diameter Ells With Tangents**

Here are the face-to-face and center-to-face dimensions of the three-diameter radius weld ells which are being used more and more in natural gas compressor station piping.



Degree Ell	Outside Diameter	A (Center To Face)	A With 4″ Tan	A With 6″ Tan
30°	16″	1′-0 7/8″	1′- 4 7/8″	1′- 6 7/8″
30°	20″	1′-4 1/16″	1′- 8 1/16″	1′-10 1/16″
30°	24″	1′-7 5/16″	1′-11 5/16″	2′- 1 5/16″
30°	26″	1′-8 7/8″	2′- 0 7/8″	2′- 2 7/8″
30°	30″	2′-0 1/8″	2′- 4 1/8″	2′- 6 1/8″
45°	16″	1′-7 7/8″	1′-11 7/8″	2′- 1 7/8″
45°	20″	2′-0 7/8″	2′- 4 7/8″	2′- 6 7/8″
45°	24″	2′-5 13/16″	2′- 9 13/16″	2′-11 13/16″
45°	26″	2′-8 5/16″	3′- 0 5/16″	3′- 2 5/16″
45°	30″	3′-1 1/4″	3′- 5 1/4″	3′- 7 1/4″
90°	16″	4′-0″	4′- 4″	4′- 6″
90°	20″	5′-0″	5′- 4″	5′- 6″
90°	24″	6′-0″	6′- 4″	6′- 6″
90°	26″	6′-6″	6′-10″	7′- 0″
90°	30″	7′-6″	7′-10″	8′- 0″

WHAT'S HAPPENING IN PIPE LINE CONSTRUCTION

By Donald G. DePugh, Construction Editor

Mid-America Pipe Line Moves North

Traversing the heart of the farm belt, Mid-America Pipeline Company's LPG line cuts through a corn field near Iowa City, Iowa. A total of 1,331 miles of the 2,169-mile LPG system from Texas-New Mexico to Minnesota-Wisconsin has been completed. Williams Brothers Company is building the main line and McVean & Barlow is laying gathering lines in Texas.

Tennessee Gas Signs Agreement With Southern California Edison Company

An agreement between Tennessee Gas Transmission Company and Southern California Edison Company of Los Angeles for new gas supplies to Edison has been signed. Up to 455 MMcf of gas daily will be delivered over a 20-year period beginning in 1962.

The gas will come from South Texas and Mexico and be delivered through a pipe line from Reynosa to the Mexico-California border. Tennessee recently signed an agreement with Petroleos Mexicanos, government oil agency of Mexico covering construction and operation of the 1,200-mile, 34-inch, $165 million line from Reynosa to California. It also covered participation by Pemex in furnishing Mexican gas as a part of the supply for the project. Pemex will own and operate the 1,200-mile Reynosa to Mexicali line.

The entire $225 million project will include a pipe line from South Texas gas fields to Reynosa where it will connect with the Pemex line, and 280 miles of pipe lines to be constructed in California.

Tennessee Gas will arrange for the gas supply for the project, construction of the entire pipe line, including the line in Mexico for Pemex, arrange for financing of the Pemex line and the setting up of a Mexican corporation to provide its maintenance and technical supervision.

Pentzien, Inc. Installing Dual 24-Inch River Crossing

Texas Eastern Transmission Corporation has awarded a contract to Pentzien, Inc. for installation of dual 24-inch pipe line crossings of the Juniata River and West Branch of the Susquehanna River near Lewistown, Pa. and Renovo, Pa.

Continental Oil Lets Contract to Panama, Inc.

Continental Oil Company has awarded a contract to Panama, Inc. for construction of 65 miles of 16-inch and 8 miles of 24-inch pipe lines in Louisiana. The line begins in Lake Charles, La. and extends to the Maurice-Milton area in Vermilion Parish, Louisiana.

Panhandle Eastern Hearing Set by FPC for October 11

The Federal Power Commission has scheduled a hearing for October 11 on an application filed by Panhandle Eastern Pipe Line Company proposing construction of a lateral in Western Oklahoma and Kansas.

Panhandle would lay about 150 miles of 24-inch and 50 miles of 22-inch lateral lines at an estimated cost of about $15.7 million. The line would extend from the Elk City Field in Beckham County, Okla., to its Haven compressor station in Reno County, Kansas.

The additional facilities would enable the company to gain access to more than three-quarters of a trillion cubic feet of proven gas reserves now committed to Panhandle. Reserves are located in the Elk City Field and also in the Avard, West Chester and Northeast Seiling Fields.

South Texas Receives FPC Examiner Approval

South Texas Natural Gas Gathering Company, subsidiary of Coastal States Gas Producing Company, has been authorized by Federal Power Commission examiner Alvin A. Kurtz to sell natural gas to Transcontinental Gas Pipe Line Corporation.

The examiner also authorized 41 producers to sell natural gas to South Texas for resale to Transco. Gas will be purchased by South Texas in various fields in Hidalgo, Starr, Duval, Brooks, Webb and Zapata counties, Texas.

South Texas will construct about 200 miles of pipe line, laterals and gathering lines in various fields, and an 880 horsepower compressor station at a cost of about $5.5 million. Transco was authorized to construct about 29 miles of 20-inch pipe line and a measuring station and to install an additional 2,500 hp unit at an existing compressor station. Cost will be about $2.2 million. The examiner's decision is subject to review by the full commission.

Northern Natural Gas Co. FPC Certificate Amended

The Federal Power Commission amended a certificate issued to Northern Natural Gas Company deleting or revising portions of authorized construction. The overall cost is reduced from $114,618,000 to $101,469,000.

Northern was authorized to lay about 430 miles of large diameter lines; 2,178 miles, branch lines; 57,400 hp and 303 border town stations. But Northern, in a petition to amend the certificate, said it would not need $6,473,260 of the proposed facilities since it would not be giving service to 46 of the 342 communities for which service was authorized. Several distribution companies and the Iron Ranges Natural Gas Company were not able to take gas from Northern, because they could not meet conditions of the July 31 Commission order. Other minor adjustments will result in savings of about $6,675,740.

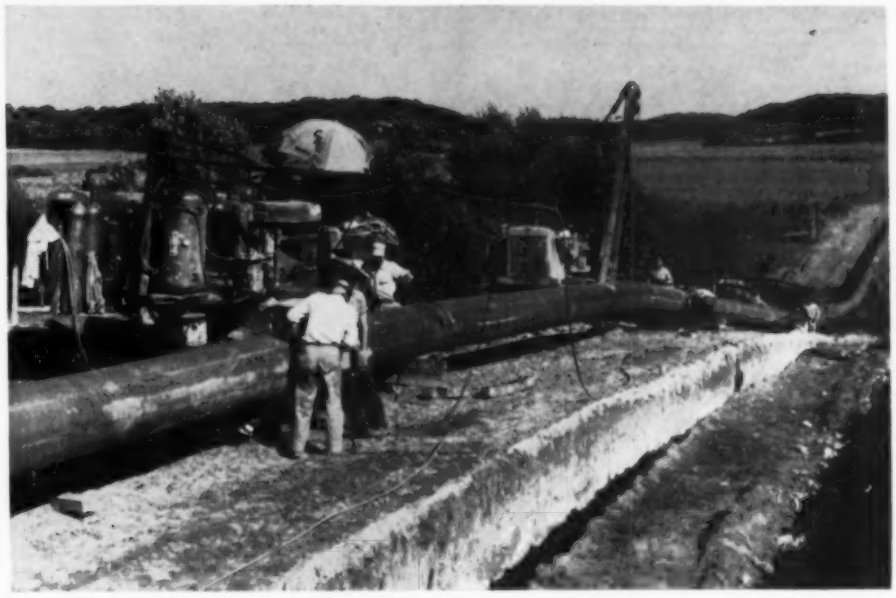
Atlantic Seaboard To Lay 19 Miles of Gas Loop Lines

The Atlantic Seaboard Corporation has been authorized by the Federal Power Commission to construct about 13 miles of 26-inch and 6 miles of 20-inch loops in Virginia and Maryland. Facilities will be used to increase capacity of the company's Cobb-Baltimore pipe line.

John C. Mason Appointed General Counsel for FPC

The Federal Power Commission has appointed John C. Mason, a career staff member, general counsel of the commission. Mason has served as the FPC's deputy general counsel since 1957 and succeeds Williard W. Gatchell, who retired after 29 years service with the commission.

Mason has been a member of the staff since 1934 when he started as a clerk. He has served as an attorney on its legal staff since 1941. In 1955 he was appointed assistant general counsel. He received his law degree in 1940 from George Washington Law School. He is a member of the bar of the District of Columbia, the U.S. Supreme Court, as well as several of the U.S. Courts of Appeals. Mason also is a member of the Federal and American Bar Association.



Midwestern Gas Line Completed

Midwestern Gas Transmission Company has completed construction of its 504-mile, 24-inch gas line from near Emerson, Man., to Marshfield, Wis. Above, Panama Inc., welders make progress on spread near Colfax, Wis. The line will take gas from Trans-Canada Pipe Lines Limited at Emerson.

Federal Power Commission Denies Certification to Transcontinental

The Federal Power Commission failed to authorize a $52 million expansion project for Transcontinental Gas Pipe Line Corporation on grounds that the evidence of gas supplies is inadequate to justify certification.

The Commission remanded the case to one of its presiding examiners, Robert M. Weston, who, in an August 5 decision, had found Transco's reserves adequate for a 12-year period.

The FPC said Transco included in its gas supply 234,126 MMcf of gas certificated in an earlier proceeding which is now subject to rehearing as to whether a price condition should be attached to the producer certificates. The producers have refused to attach the gas until the price question is resolved. Until producers commit the gas to interstate service, the FPC said, Transco cannot include it in its gas supply showing.

The Commission rejected Transco's claim of 292,835 MMcf of non-flow tested reserves. Transco also proposed to purchase its largest volume of gas from certain fields in the later years of their life, the Commission stated. It is questionable whether any producer will consider it good procedure to drill the additional wells necessary at a time when the field is nearing depletion, the FPC said.

The Commission's present action remands only the question of gas supply back to the examiner.

Ohio Pipe Line Awarded Contract on 24-Inch Line

Cincinnati Gas & Electric Company has let a contract to Ohio Pipe Line Construction Company to lay approximately 5 miles of 24-inch pipe line and a crossing of the Little Miami River near Cincinnati, Ohio.

Ohio Pipe Line Construction also has a contract with Buckeye Pipe Line Company for station work at Trenton pump station and Aurora pump station in Wayne County, Mich.

El Paso Authorized To Build Facilities

El Paso Natural Gas Company has been authorized by the Federal Power Commission to construct and operate facilities costing about $4 million.

El Paso will install 6,800 hp in its Goldsmith compressor station and build facilities to provide an additional 58 MMcf per day capacity at its Goldsmith purification and dehydration plant. The new facilities will be located in Ector County, Texas.

PROPOSED PIPE LINE CONSTRUCTION

Here in convenient summary form is Pipe Line Industry's listing of company, line size, length, service, location and project status.

U.S.

Algonquin Gas Transmission Co., Boston, 25 miles, 20-inch; 8 miles, 8-inch, gas, and 12,000 hp addition in Massachusetts, $6 million, before FPC.

Arkansas Louisiana Gas Company, Shreveport, La., 58 miles, 2-6-inch, gas, planned.

Belle Fourche Pipeline Co., Casper, Wyo., 103 miles, 8-inch, crude, Fiddler Creek field to Lance Creek, Wyo., and branch lines from North Donkey Creek field to Rozet and Miller Creek fields, $2¾ million, approved by Wyoming Public Service Commission.

Border Gas Transmission Company, 300 to 400 miles, gas, gathering, in south Texas, $10 million, planned.

Buckeye Pipe Line Co., New York, 54 miles, 16-22-inch, crude, main lines from Toledo to Samaria, and Detroit, Mich., $4 million, contract let on 41 miles of 16- and 22-inch to **Panama Williams Corp.** and **Somerville Construction Co.**

97 miles, 10-inch products, Lima to Lebanon, Ohio, contract let to **Shamrock Construction Co.**

Carolina Pipeline Company, Columbia, S. C., 85 miles, 8-inch, gas, in South Carolina, $5 million, before FPC.

Coastal States Gas Producing Co., Corpus Christi, Texas, 60 miles, 10-inch, gas, gathering, La Salle and Frio counties, Texas, before FPC.

60 miles, small diameter, gas gathering line, to tie in with system under construction and extend to Pearsall County, Texas, planned.

25 miles, gas, Associated Gas & Oil Co. field to South-Tex Corp., processing plant west of Corpus Christi, Texas, planned.

37 miles, gas gathering in Brown, Eastland, Comanche and Erath counties, Texas, planned.

Coastal Transmission Corp., Houston, 81 miles, 3 to 10-inch, gas, laterals; 5,500 hp in stations at Port Lavaca, Texas, and Eunice, La., and additional 1,500 hp at Robstown, Texas, $6.2 million, before FPC.

Colorado Interstate Gas Co., Colorado Springs, 140 miles, 34-inch, gas, Green River, Wyo.,-to-Provo, Utah; 109 miles, 26-inch, Texas Panhandle to southeastern Colo., 136 miles, 34-inch, southeastern Colorado-to-Pueblo, Colo.; 107 miles, 30-inch, Pueblo-to-Denver, $91 million, FPC examiner approval.

Colorado Oil & Gas Corp., Denver, 400-miles, gas, from Gubik field to Fairbanks, Alaska, planned.

Columbia Gulf Transmission Co., Houston, 12.8 miles, 6 and 20-inch, gas, loop line in Louisiana, $730,000, authorized.

Continental Oil Co., 65 miles, 16-inch and 8 miles, 24-inch, Lake Charles to Maurice-Milton areas in Vermilion Parish, La., contract let to **Panama, Inc.**

East Coast Pipeline Co., 90 miles, 12- to 24-inch, products, Linden, N. J. to Suffolk County, N. Y., $25 million, planned.

El Paso Gas Supply Company, El Paso, Texas, 228 miles, 30-inch, gas, main, Live Oak to Sutton County, Texas, $30 million, planned.

El Paso Natural Gas Company, El Paso, 199 miles, 30-inch, Permian-San Juan crossover loop, before FPC.

17 miles, from Pacific Gas Transmission Co. facilities to near Spokane, Wash., before FPC.

34 miles, 20-inch, Puckett to Goldsmith, before FPC.

23 miles, 20-inch, Goldsmith to Eunice-Plains line, before FPC.

9 miles, 20-inch, Goldsmith-Plains loop, before FPC.

43,600 hp in new and existing stations in Texas, Oklahoma, New Mexico and Utah, before FPC.

400 miles, 34-inch, Salt Lake City, Utah, to California border, FPC examiner approval.

El Paso Natural Gas Products Company and **El Paso Products Pipeline Co.,** 32 miles, 6-inch, crude, from Patrick Draw Oil and Gas Field to Wamsutter, Sweetwater County, Wyoming, before Public Service Commission.

Equitable Gas Company, Pittsburgh, Pa., 31 miles, 16-inch, and 26 miles, 20-inch, in West Virginia and Pennsylvania, $5 million, before FPC.

Goliad Corp., Houston (Joint venture with **Union Oil Co. of Calif.**), 85 miles, LPG, Kaplan, La. to Baton Rouge, extraction plant at Kaplan and fractionation plant at Baton Rouge, $12 million, planned.

Great Northern Railway, St. Paul., 110 miles, crude, fields in Burke and Bottineau counties to Minot, N. D., $3½ million, contract let on 50 miles to **Curran and Company.**

Hope Natural Gas Co., Clarksburg, W. Va., 45 miles, gas, from West Virginia to Pittsburgh area, planned, 20 miles, 24-inch, gas, in Wertzel and Monongalia counties, W. Va., authorized.

Houston Texas Gas & Oil Corp., St. Petersburg, Fla., 199 miles, 2 to 6-inch, gas, laterals; 20,000 hp in five new stations; $12 million, before FPC.

Iron Ranges Natural Gas Co., 115 miles, gas, from Itasca and St. Louis counties along route of Mesabi range from Grand Rapids to Aurora, Minn., $5 million, FPC authorization.

60 miles from Duluth to Silver Bay, Minn., FPC authorization.

Kansas-Nebraska Natural Gas Company, Hastings, Neb., 165 miles, 2-8-inch, gas, extension from Alliance, Neb., to Chadron, Crawford, Hemingford, Hay Springs, Gordon and Rushville, Neb., before FPC.

45 miles, 2-3-inch, gas, in Kansas, approved by Kansas Corporation Commission.

2,000 hp addition at Scott City, Kan., FPC approval authorization.

2,500 hp addition at Holcomb, Kan., before FPC.

Lo-Vaca Gathering Co., 230 miles, 6-20-inch, gas, gathering, Live Oak to Lavaca County, Texas, planned.

Manufacturers Light and Heat Company, Pittsburgh, 103 miles, 20-inch, gas, in Franklin, Adams, Fayette, Green, Fulton and Somerset counties, Pa., $7 million, contract let on 70 miles to Williams Bros. Co.

Matador Pipe Line Corp., Denver, 175 miles, crude, from Bottineau, Burke and Renville counties, N. D., to Cromer, Man., Canada, $4 million, proposed.

Michigan Wisconsin Pipe Line Co., Detroit.

37 miles, 6 and 12-inch lateral loops in Wisconsin, before FPC.

29 miles, 30-inch, loops, Illinois, Indiana, and Michigan, 3,000 hp. station, Janesville, Wis., before FPC.

Two 2,000 hp units at Meade, Kansas; one 2,000 hp unit at Havensville, Kansas, before FPC.

Mid-America Pipe Line Co., 405 miles, 10-inch, LPG, Superior, Wis., to Chicago, $12 million, planned.

Mississippi River Fuel Corp., St. Louis, 20 miles, 12-inch, 3 miles, 4-inch, gas, 2,500 hp station, to develop underground storage reservoir at St. Jacobs field in Madison and St. Clair counties, Ill., $3 million. Before FPC.

Mississippi River Transmission Corp., (subsidiary Mississippi River Fuel), 115 miles, 18-inch, gas, southeast Missouri to St. Louis County, planned.

Natural Gas Gathering Co., Inc., (joint venture with Gulf Resources, Inc.) gas gathering facilities in Zapata and Starr counties Texas, before FPC.

Natural Gas Pipeline Company, Chicago, 62 miles, gas, pipe line and various river crossings, before FPC.

New Haven Pipeline, Inc., products line, New Haven, Conn. to Springfield, Mass., $2.5 million, planned.

Niagara Mohawk Power Corp., 122 miles, 12-inch, Watertown and Massena, N. Y., contract let to Fulghum Contracting Corporation pending FPC approval.

Northern Natural Gas Company, Omaha, Neb., 236 miles, gas, in Kansas, Nebraska, Iowa, Illinois and Wisconsin, and 14,050 hp, $25 million, before FPC.

124 miles, in Oklahoma, Kansas, Nebraska, Iowa, and Minnesota and 17,360 hp, $17 million, before FPC.

22 miles, in Iowa, $673,100, before FPC.

Northwestern Refining Co., crude gathering system, Rival and Lignite fields, North Dakota, $625,000, Public Service Commission approval.

Ohio Fuel Gas Co., 59 miles, gas, 4-24-inch main lines, in Belmont, Carroll, Cuyahoga, Fairfield, Logan, Lorain, Marion, Muskingum, Stark and Wayne counties, Ohio, $5.1 million, planned.

Pacific Gas & Electric Co., San Francisco, 296 miles, 36-inch, gas, from Malin, Ore., to Antioch, Calif., southern section of line from Canada to California, $82 million, authorized by California Public Utilities Commission.

Pacific Gas Transmission Co., San Francisco, 614 miles, 36-inch, Kingsgate, B.C. to Malin, Ore., northern section of Canada to California line, $133 million FPC authorization.

Panhandle Eastern Pipe Line Co., Kansas City, 305 miles, 30-inch, 40 miles, 26-inch, gas, loops, and 43,000 hp, and gathering facilities, $60 million, before FPC.

200 miles, 22-24-inch, gas, lateral, from Elk City, Okla., to Haven, Kan., before FPC.

Peoples Gas Light & Coke, Chicago, 29 miles, 36-inch, gas between North Shore and Calumet stations, planned.

Peoples Gulf Coast Pipeline Company, Chicago, 27 miles, gas and turbocharger additions to 71 compressor engines, befor FPC.

Rio Gas Gathering Co., San Antonio, 97 miles, 3 to 8-inch, gas gathering, South Texas, to supply gas to El Paso Natural Gas Company, planned.

Southern California and Southern Counties Gas Cos., Los Angeles, 93 miles, 34-inch, California-Nevada border to Newberry, Calif., approved.

St. Lawrence Gas Company, Inc., Ogdensburg, N. Y., 75 miles, gas, main, United States-Canadian border to Ogdensburg, N. Y., $3.4 million, FPC examiner approval.

Tennessee Gas Pipeline Co., Houston 191 miles, 30 and 36-inch loops, in Ohio, Pennsylvania and New York, 72 miles of gathering lines and 43,600 hp in five stations, $46 million before FPC.

158 miles, 36-inch, gas, loops in Mississippi and Louisiana, FPC authorization.

21 miles, 16-inch, 2 miles, 12-inch, gas, Louisiana coast, Vermilion blocks 46 and 64, $3 million, before FPC.

Texas Eastern Transmission Corp., Shreveport, La.

66 miles, 30-inch, gas, loops, between Vidor, Texas and Lambertville, N. J., and 33,710 hp in four existing stations, $17.5 million, before FPC.

Extension of products line from Lebanon, Ohio, to Elmira, N.Y., considered.

350 miles, 24-inch, coal slurry, West Virginia to New York, considered.

Texas Gas Transmission Corporation, Owensboro, Ky., 23 miles, 30-inch, gas, loops, between Eunice and Bastrop, La., 56 miles, 12-inch, in Indiana. $8 million, contract let to **Western Pipe Line, Inc.**, and **Houston Contracting Co.**

Transcontinental Gas Pipe Line Corporation, Houston.

211 miles, 36-inch, and 69 miles, 30-inch, loops and additional 32,040 hp, in Texas, Louisiana, Mississippi, Alabama, Georgia and South Carolina, $52 million, FPC examiner approval.

13 miles, 24-inch and 18 miles, 20-inch loops, Louisiana, FPC authorization. 14 miles, 16-inch laterals, 1-mile, 12-inch lateral, Louisiana, $2.1 million, FPC authorization.

29 miles, 20-inch, gas, and 2,500 hp, in South Texas to take gas from South Texas Natural Gas Gathering Co., $2.4 million, FPC authorization.

Trans-Southern Pipeline Corp., Houston, 1,080 miles, 12-inch, LPG, from Mont Belvieu, Texas, to Danville, Va., and 215-mile spur line from Atlanta to Georgia-Florida border, $63 million, planned.

Transwestern Pipeline Company, Houston, pipe line facilities to cost $5.4 million to make available additional gas reserves for the line, FPC authorization.

Trunkline Gas Company, Houston, 252 miles, 30-inch loops, and 140 miles, laterals, between Longville, La., and Tuscola, Ill., $45 million, before FPC.

Underground Storage & Exploration, Upper Darby, Penn., 394 miles, 12-inch LPG, from Moundsville, W. Va. to Newark, N. J., $9 million, approved.

95 miles, 6-8 inch, laterals to Mauch Chunk, Penn., and to Philadelphia, planned.

United Gas Pipe Line Co., Shreveport, La., 59 miles, 36-inch, gas, lateral between Bastian Bay field and Plaquemines Parish, La., before FPC.

Valley Gas Transmission, Inc., Houston, 55 miles, 3 to 8-inch, gas, gathering, in Hidalgo, Brooks, Starr and Jim Wells counties, Texas, $15 million, before FPC.

West Shore Pipe Line Co., 250 miles, 10-16-inch, products, East Chicago, Ind., to Green Bay, Wis., planned.

International

ACT Oils, Ltd., Montreal, 400 miles, crude, Dawson Creek, B. C., to Bella Coola, B. C., before B. C. government.

Ajax Alberta Pipeline Ltd., 28 miles, 10-inch, gas, main, Morinville to Westlock, Alta., planned.

Alberta Gas Trunk Line Company, 386 miles, 26-36-inch, gas, main, Berland River area, Alberta, to Alberta-British Columbia border; and 235 miles, 8-18-inch, gas, gathering, Alberta, $100 million, Alberta Oil and Gas Conservation Board, approved.

Alberta Natural Gas Company (Jointly owned by Westcoast Transmission Co. and Alberta & Southern Gas Co. Ltd.) 110 miles, 36-inch, gas, Alberta border to British Columbia-Idaho border, supply gas to Pacific Gas & Electric Co., $40 million, planned.

Assistencia de Oleodutos du Petrobras, Rio de Janeiro, 280 miles, 12-inch, crude, Rio de Janciro to Belo Horizonte, Brazil, planned.

Abu Dhabi Marine Areas Ltd., (British Petroleum Co. and Compagnie Francaise Des Petroles) 20 miles, 18-inch, crude, from Umm Shaif offshore oilfield to Das Island, Persian Gulf, planned.

Barnabos Group (Italian Interests), crude line from Venice, Italy, to Insbruck, Austria, with extension to Munich, Germany, planned.

Bituminous Oil Pipeline Co., Calgary, 250 miles, crude, from Athabasca tar sand plant in northeastern Alberta to Edmonton, approved.

British American Oil Co., Ltd., Toronto, 125 miles, gas, Pincher Creek fields to Calgary, Alta., before Alberta Public Utilities Board.

Burmah Oil Co., Ltd., 850 miles, crude, 20 inch, from Nahorkatiya to Calcutta, India. Contract let on 250 miles to Mannesmann-Saipem.

Cartier Gas Corp. (St. Maurice Gas, Inc., and Consumers Gas Co., Toronto), 170 miles, gas, Montreal to Quebec City, planned.

Consolidated Gathering Systems, Ltd., Calgary, 198 miles, crude, Sturgeon field to Edmonton, planned.

Creole Petroleum Co., 44 miles, 12-30-inch, gas, Bachaquero to Tia Juana, Venezuela, planned.

Esso Standard Libya, 100 miles, 30-inch, crude, Zeltan oil field to Gulf of Sirte Coast, contract let to **Bechtel Corporation.**

Foothills Pipe Lines Ltd., 1,300 miles, LPG, from Alberta-Saskatchewan border to Chicago, tie-in with Westalta Products Pipeline proposed system in Alberta, $100 million, before Alberta Board of Public Utilities Commissioners.

Gas Trunk Line of British Columbia, Vancouver, 250 miles, 30-inch, gas, main, Fort Nelson to Taylor, B. C., planned.

Gases Naturales de Colombia, S.A., 140-mile, 10-inch, gas, Cicuco field to Barranquilla, Colombia, planned.

Hughenden Pipeline, 125 miles, products, Dick Lake gasoline plant to Hughenden Region, Alta., planned.

Hydrocarbons Pipeline, Ltd., Winnipeg, Manitoba, 880 miles, 6-8 inch, products, from Edmonton to Winnipeg, $35 million, partial authorization.

Independent Pipe Line Co., 2,019 miles, 34-36-inch, crude, Edmonton to Montreal, 23,000 pump horsepower, $395 million, before Borden Commission.

Interprovincial Pipe Line Company, 350-mile extension from Toronto to Montreal, looping line from Edmonton to Toronto, crude, $240 million, considered.

Additional horsepower in four new stations and several existing stations, $9.3 million, planned.

Magna Pipeline Co., 25 miles, 4-inch, gas, Vancouver, B.C. to Vancouver Island, $14 million, approved by Public Utilities Commission.

Mid-Continent Pipe Lines, Ltd., 1500-mile, 30-inch crude, Edmonton to Chicago, planned.

Naphtha Israel Oil Co., 75 miles, 6-inch, gas, Rosh-Zohar field to Ashdod Yam on Mediterranean planned.

National Iranian Oil Co., 146 miles, 6 inch, crude, from Azna to Isfahan, Iran, $5 million, planned.

Northern Alberta Pipe Lines, Ltd., Edmonton, Alta., 110 miles, 10-inch, gas,

main, Lac La Biche to Edmonton, $3 million, planned.

Northern Pipe Line Company, 153 miles, 16-inch, crude, from Regina, Saskatchewan, to Clearbrook, Minn., $10 million, planned.

Oasis Oil Co. of Libya, 100 miles, 30-inch, crude, Libyan production to Mediterranean, planned.

Peace River Oil Pipe Line Co., Ltd., 70-mile, crude, Swan Hills to Iosegun Junction, approved.

Pembina Pipe Line, Ltd., Edmonton, 1,200 miles, LPG, from Alberta gas fields to eastern Canada, planned.

Petroleos Mexicanos, 4, 6 and 8-inch, products, Mexico City-Puebla to Cuernavaca, planned.

1,240 miles, 34-inch, gas, Reynosa to San Luis Rio Colorado, Mexico, $160 million, negotiating with Tennessee Gas Pipeline Company for design and construction of the line.

8-inch, products, and 12-inch, gas Torreon to Chihuahua, to be built in 1960.

360 mile, 12-inch, products, Minatitlan to Puebla and Mexico City, construction to start in 1960.

Products, Guadalajara to Tepic, planned.

Products, Aguascalientes to Zacatecas, planned.

6-inch, products, Guaymas to Ciudad Obregon, considered.

8-inch products, Guaymas to Hermosillo, considered.

8-inch, gas, Tierra Blanca to Veracruz, to be built in 1960.

14-inch, gas, Mexico City to Salamanca, construction to start in 1960.

Gas, Ciudad Carmen to Ciudad Pemex.

8-inch, crude Comalcalco to Minatitlan, to be built in 1960.

Crude, Minatitlan to Salina Cruz, contingent on proposed refinery on Pacific Coast.

149 miles, 10-inch, products, Ciudad Pemex to Minatitlan, planned.

181 miles, 4-inch, products, Mexico City to Salamanca, planned.

Pipelines of Puerto Rico, Inc., 95 miles, 8-inch, products, Penuelas to San Juan, Puerto Rico, approved.

Provincial Pipe Lines, Ltd., 700 miles, 3-16-inch, hydrocarbon line gathering system in Alberta, $25 million, before Alberta Oil and Gas Conservation Board.

Quebec Gas Transmission Lines, Inc., Montreal, 300 miles, gas, main, Quebec to Montreal, planned.

Rangeland Pipe Line Company Limited, 111 miles, 8-inch, crude, southeastern Alberta to Calgary, $3 million, planned.

Saskatchewan Power Corp., 179 miles, 4-6-8-inch, gas, planned.

Societa Nazionale Metanodotti, 650 miles, 18-inch, crude, Genoa, to Milan-Cremona-Torino, Italy, and Aigle, Switzerland, with extensions to Karlsruhe and Munich, Germany, planned.

Societe d'Etude du Pipe Line Sud-European, Paris, 419 miles, 30-inch, crude, port of Lavera to Strasbourg, with lateral extending 40 miles to Karlsruhe, Germany, approved by French cabinet.

Soc. Siciliana Metanadotti, gas line from Hassi R'Mel field in Algeria through Tunisia, across Mediterranean to Sicily and into Italy, considered.

Standard-Vacuum Oil Company, 60 miles, 8-inch, gas, main, in South Sumatra, considered.

Ste. d-Etudes de Pipeline Intercontinetaux, Paris, 1,400 miles, 30-40-inch, gas, from Hassi R'Mel field in central Algeria across Mediterranean, through Spain, France and into West Germany, considered, Fish International Corporation making engineering and feasibility studies.

Sui Gas Transmission Co., Multan, Punjab, India, 145 miles, 8-inch, gas, from Sylhet to Dacca, East Pakistan, $9 million, considered.

130 miles, 16-inch, gas, main line, Multan to Lyallpur, planned.

Syrian Pipeline, Damascus, 500 miles, crude, from Karshuk field, Syria to Mediterranean, planned.

300 miles, products, from Homs to tank farms in Damascus, Aleppo and Latakia, planned.

Trans-Canada Pipe Lines Limited, Toronto, 50-mile, 30-inch, gas, lateral, Winnipeg to Emerson, Manitoba; 74 miles, 34-inch, loops, additional compressor hp at Swift Current, and Indian Head, Saskatchewan, and Portage la Prairie, Manitoba, $45 million, contract let on 50 miles to **Majestic Contractor, Ltd.**

268 miles, 34-inch, loops, and additional hp planned for 1961, $69 million.

122 miles, 34-inch, loops, hp additions, $46 million, planned for 1962.

Trans-Prairie Pipelines, Ltd., Edmonton, crude line, from Weyburn field to Regina-Moose Jaw areas, $5 million, considered.

Westalta Products Pipeline Ltd., 900 miles, LPG, from Northern Alberta to Saskatchewan border, to deliver hydrocarbons to Foothills Pipe Lines, $40 million, before Alberta Board of Public Utilities Commissioners.

Williams-McWilliams Industries, Inc., New York, 441 miles, 6-inch, crude, Villa Montes, Bolivia to Villa Hayes, Paraguay, considered.

Westcoast Transmission Company, 688 miles, 30-inch, gas, loops, Peace River area of British Columbia to United States border, planned.

Yacimientos, Petroliferos Fiscales Argentina, Buenos Aires, 1,000-mile, large diameter, gas, Comodoro Rivadavia to Buenos Aires, $300 million, considered.

H. C. Price Laying Telephone Cables

American Telephone and Telegraph Company has awarded a contract to H. C. Price Company—Coating Division for the trenching and placing of multiple cables between Pottstown, Pa. to a point 9 miles south of Frederick, Maryland, a distance of about 122 miles.

Buckeye Awards Contract To Shamrock Construction

Shamrock Construction Company has been awarded a contract by Buckeye Pipe Line Company for construction of 97 miles of 10-inch products line. The line will extend from Lima to Lebanon, Ohio.

Houston Contracting Co. Laying 24 Miles, 30-Inch

Houston Contracting Company has been awarded a contract by Texas Gas Transmission Corporation to lay 24 miles of 30-inch between Monroe and Eunice, La. Texas Gas also is constructing about 56 miles, 12-inch, in Indiana.

O. R. Burden, Veteran Pipeliner, Dies at 74

O. R. Burden, 74, president of O. R. Burden Construction Corporation, died September 10, in Tulsa, after 50 years of service in the pipe line industry.

Burden began his pipe line career with the Texas Pipe Line Company in 1910. He advanced through various assignments to manager of the North Texas Division. In 1939 he joined Panhandle Oil and Refining Company as vice president and general manager. He formed two partnerships in pipe line and drilling industry in 1941. The Burden and Wright Construction Company was established for pipe line work and Burden and Riley Drilling Company was formed for drilling oil wells.

In 1942, he dissolved his partnerships and accepted a position as general superintendent of War Emergency Pipelines, Inc. In 1947 he joined B. E. Hull in construction of the Trans-Arabian Pipe Line between the Persian Gulf and Mediterranean and he became president of the Pacific Pipe Line and Engineering Company in 1948.

He started the O. R. Burden Construction Corporation in 1949 with headquarters in Tulsa. A resident of Wichita Falls, Texas, he took an active part in its civic affairs, having held the presidency of such organizations as the Chamber of Commerce, School Board, Kiwanis Club, Wichita Club, and Boy Scouts. In 1936 he was voted the Most Useful Citizen of Wichita Falls.

ON THE LINE

Commemorate Transwestern Pipe Line

State officials of California and Texas commemorated initial deliveries of gas through Transwestern Pipeline Company system to California September 19 at a Los Angeles Chamber of Commerce luncheon. Among those participating were, left to right, William M. Bennett, chief counsel, California Public Utilities Commission; Mills Cox, president, Transwestern Pipeline Company; Ben Ramsey, lieutenant governor, State of Texas; William K. Warren, chairman of the board, Transwestern; Robert A. Hornby, president, Pacific Lighting Corporation.

Free Coffee

Here's a safety idea that's hard to beat.

The Sheriff's Department, 4-H Club and Grain Dealers of Iowa's Wright County, sponsored a "free coffee and donuts stop" marathon over the Labor Day weekend which encouraged drivers to slow down and drink . . . coffee. The roadside coffee stop was located near an intersection of two busy highways.

Volunteers worked around the clock during the long weekend to keep drivers perked up.

The safety project was started in 1954 to promote safety on the highways by calling attention to the drivers that it is necessary to take a break on long trips. Money for the project is donated by local businessmen throughout the county.

Esso Education Grant

Esso Education Foundation will grant a series of lectures by scientists during the 1960-61 academic year at the University of Tulsa. The grant will be used for an in-service institute in the physical and life sciences for junior and senior high school science teachers in the Tulsa area.

Companies participating in the foundation are Standard Oil Co. (New Jersey); Esso Export Co.; Interstate Oil Pipe Line Company, and Esso Tankers, Inc.

In addition to this grant for the in-service institute, the Esso Education Foundation has, for several years, assisted the University of Tulsa through a number of grants for general and other purposes.

Visiting Scholars

A group of well known scholars headed by Dr. Edward Teller, will visit Texas universities next year participating in the Robert A. Welch Foundation Visiting Scholar Program. Teller, from University of California, will be at Rice University where he will participate in theoretical research, give lectures and advise graduates.

Dr. Daniel Bovet, Nobel laureate in physical chemistry and professor at University of Rome, will visit Southwestern Medical School in Dallas. Dr. Hans Jonassen, chemistry professor at Tulane, plans to visit The University of Texas in Austin. Dr. Moddie D. Taylor, Howard University, will be at Prairie View A&M College and Dr. W. B. Smith, Ohio University, will visit Texas Christian University.

NACE Conference

An oil and gas pipe line symposium is scheduled during the South Central Region NACE conference, October 25-27, at the Mayo Hotel in Tulsa.

One paper will consider factors in the formulation and application of coal tar epoxy coatings. Of interest to pipe line corrosion engineers will be the symposium on underground corrosion to be held during the Northeast Region Conference, Huntington, W. Va., October 11-14 at Hotel Prichard. During this meeting, Technical Committees T-6A, T-6A-12 and T-6F on coatings will meet.

The NACE Western Conference at San Francisco, October 6-7 will include one symposium on coatings, linings and plastics, and another on underground structures. A paper on Continuous Recording of Pipe-to-Soil Potentials vs. Distance has been scheduled.

Boost Pressure

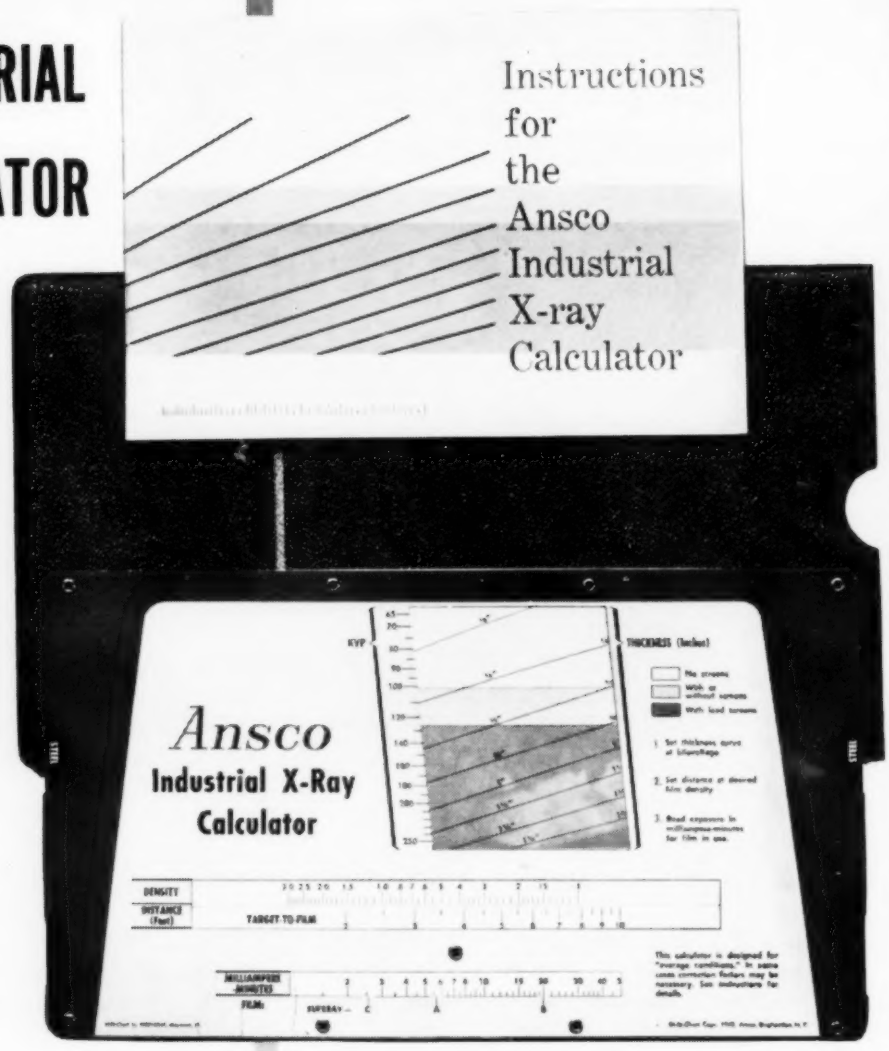
In Corpus Christi, Texas, an experimental run of a natural gas turbine as part of a system to boost gas well head pressure to pipe line pressure was started last month.

The 100 horsepower turbine is serving round-the-clock as a first stage compressor to replenish pressure lost by depletion in a gas gathering system. Purpose of the experiment is to provide experience and performance data on natural gas burning turbines for new industrial applications.

Uranium Buried

Beverly Cline, left, and Mary Jones, secretaries at American Society for Metals, check radioactivity of uranium metal before placing it in time capsule during the ASM headquarters dedication September 14. The new geodesic-domed national headquarters are located at Metals Park, Geauga County, near Cleveland, Ohio.

NEW ANSCO INDUSTRIAL X-RAY CALCULATOR SOLVES TECHNIQUE PROBLEMS AT A GLANCE



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What's Happening among MEN in the INDUSTRY

Pipe Liners Club of Houston Elects Officers

The Pipe Liners Club of Houston elected officers for the 1960-61 year at its September meeting. Melvin A. Judah, editor, PIPE LINE INDUSTRY, was elected president. Robert D. Pyle, Tennessee Gas Pipeline Company, was named vice president; S. O. Critchfield, Shell Pipe Line Corporation, was re-elected treasurer, and J. L. Willing, Humble Pipe Line Company was named secretary. J. J. Corrigan, Transcontinental Gas Pipe Line Corporation, and James H. McBrien, F. H. Maloney Co., were elected new directors. Judah served as vice president last year, and Pyle had been secretary. Pictured, left to right, are Corrigan, McBrien, Judah, Pyle and Critchfield.

Bryan C. Edwards has been elected president of **Pan American Gas Company,** natural gas transmission subsidiary of **Pan American Petroleum Corp.** He succeeds **Gilbert F. Moore** as president and a director of Pan American. Moore resigned because of increasing responsibilities in other areas of natural gas sales work and his election as a director of **Texas Gas Corporation.** Pan American acquired a 50 percent stock interest in Texas Gas.

Bryan C. Edwards

Moore continues as manager of gas sales for Pan American and Edwards is assistant manager.

P. H. Swinchatt, assistant to the president of **Shell Oil Company** and vice president of **Shell Pipe Line Corporation,** will retire December 31, 1960, after nearly 40 years service with Shell. He will be succeeded by **E. A. Hugill, Jr.,** currently secretary of Shell.

Hugill will combine his new administrative duties with his present corporate secretarial responsibilities. He is also secretary of Shell Chemical Company, International Lubricant Corporation and Shell Canadian Exploration Company.

Walter E. Biery, president of **Mid-Continent Pipe Line Co.,** has been named president of **Suntide Pipe Line Co.,** a crude oil gathering facility on the Gulf Coast which serves the Suntide Refining Co. plant on Nueces Bay at Corpus Christi, Texas.

Biery succeeds **Glenn E. Wynn** who resigned last week to head the new Sunray Chemical Co.

Lester B. Inglis, Jr., formerly with the **Columbia Gas System's United Fuel Gas Co.,** has been named assistant secretary of the **American Gas Association's** 3,700-member Operating Section. He succeeds **Fredric Moshier** who has entered private business.

Inglis has served for the past four years as an engineer in United Fuel's Gas Measurement Department. He joined Columbia in 1953.

James A. Elkins, Jr., and **J. Finley McRae** have been elected to the board of directors of **United Gas Corporation.** Elkins is president of the First City National Bank, Houston. He is a director of Eastern Air Lines and a member of the executive committee of the Houston Chamber of Commerce. McRae has been president of the Merchants National Bank of Mobile, Ala., since 1941.

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WRITE FOR BULLETIN 019

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A. L. Vaughan

W. B. Haas

Northern Natural Gas Company has reorganized its operating division into six area offices and announces several new appointments. **A. L. Vaughan** was named to head the newly-established Operating Division, and Vice President **W. B. Haas** was placed in charge of the newly-created Construction and Engineering Division.

The new area locations and men named as area managers are **David P. Corkill,** Minneapolis, Minn.; **Evan M. Griffiths,** Des Moines, Iowa; **Ross N. Cox,** Lincoln, Neb.; **Otto V. Barbee,** Great Bend, Kan.; **Carl W. Ikard,** Liberal, Kan., and **Jackfl W. Seaman,** Midland, Texas. The area manager reports directly to the Omaha central headquarters and is responsible for all operations and maintenance of plants and pipe lines in his respective areas.

Glen Grove was named manager of administrative control and will control and coordinate the activities of the six area offices.

Jay C. McElroy, previously an engineer in the Communications Department in Houston, has been named superintendent of Station 34, Grover, N. C., for **Transcontinental Gas Pipe Line Corporation.** McElroy served five years with Transco from 1950 to 1955, and rejoined the company in 1958.

W. J. Wooten has been elected vice president and manager of explorations for **Texas Gas Exploration Corporation.** He formerly had been with the Land Department. He joined the company in 1957 as manager of Land Department. Previously he had been with Magnolia Petroleum Company in its Land Department.

Texas Gas Transmission Corporation has appointed **Charles P. Moreton** manager, gas contracts. He will be responsible for the acquisition of gas reserves, negotiation of gas purchase contracts and allocation of markets to the various contracts through proration.

Charles P. Moreton

Moreton joined Texas Gas in 1953 as a supply contract representative. Prior to his new appointment he served as supervisor, gas contracts. Before joining the company, Moreton had been associated with Arkansas Louisiana Gas Company as a gas supply engineer in its Shreveport, La., office.

C. Milton Allen, controller and assistant secretary, **Trunkline Gas Co.,** has been elected president of the Houston Control of the Controllers Institute of America.

Luke V. Patrick, controller, **Transcontinental Gas Pipe Line Corporation,** was named a new director.

James T. Noel, assistant controller, **Panhandle Eastern Pipe Line Company,** was elected president of the Kansas City Control. **Douglas G. Simpson,** controller, **Trans-Canada Pipe Lines Limited,** was chosen secretary of the Institute's Toronto Control. The Oklahoma Control chose **Robert E. Higginbotham** as its treasurer for 1960-61. He is chief accountant, **Oklahoma Mississippi River Products Line,** Tulsa. **George E. Pierce,** controller, the **Buckeye Pipe Line Company,** has been named a director of the controllers group in New York.

Lowell E. Anderson, division chief engineer in Wyoming for **Service Pipe Line Co.,** will be transferred to Tulsa on special assignment. Anderson will be replaced by **R. H. Christman,** who has been acting division chief engineer in Wyoming.

Anderson was assigned to a special project in 1959 with Pan American International Oil Co. to oversee the construction of a pipe line in Argentina. He joined Service in 1947 after working with Phillips Petroleum Co. and was named division chief engineer in 1955. Christman joined the company in 1946, and in 1959, became acting Wyoming Division chief engineer.

New York State Natural Gas Corporation has appointed **John L. Holder** and **Wilbur J. Whitehill** superintendent and assistant superintendent, respectively of the Mamont District.

Holder, formerly assistant superintendent, succeeds **Harry J. McNeely.** Whitehill was former chief engineer of stations for the district. Holder has more than 23 years service with the company and was named

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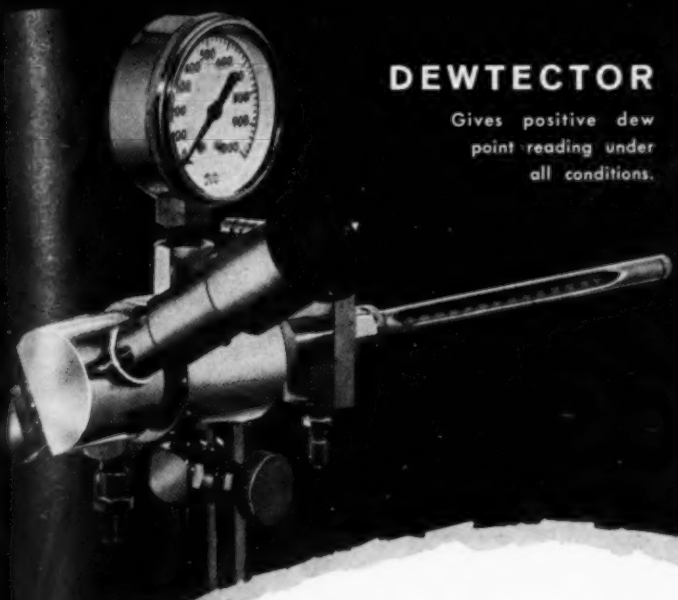

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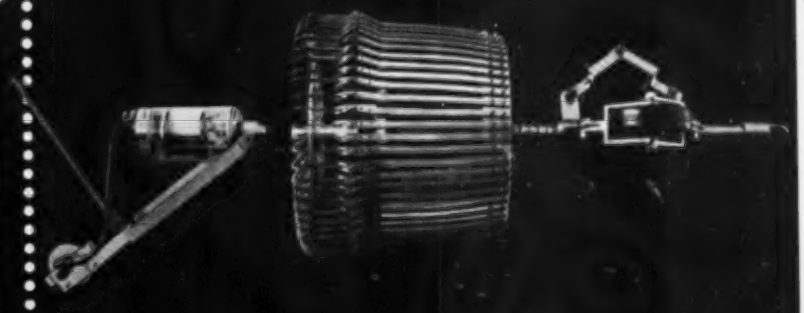

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assistant superintendent in 1958. Whitehill has 20 years service with affiliated companies of **Consolidated Natural Gas Company,** the parent firm. He was named chief engineer in 1959.

Leslie J. Silhan, Texas Pipe Line Company, who saved a fellow employe's life, was awarded the API Meritorious Safety Award and the President's Medal of the National Safety Council. The presentations were made by **J. W. Emison,** president and **S. G. Kershner,** vice president of Texas Pipe Line.

He was awarded both medals as a result of his successful first aid treatment of **Clyde Buley,** employe of the Texas Pipe Line Company, November 4, 1959. The two men were working on a tank northeast of Houston pump station when Burley collapsed after inhaling heavy concentration of sour crude oil vapors escaping from the tank. The quick action on the part of Silhan in administering first aid resulted in saving his life.

Silhan has been with the company since 1940.

Standard Oil Company of Indiana has announced several appointments in its proposed reorganization. Chairman **Frank O. Prior** will retire and **John E. Swearingen** will continue as president and become chief executive officer. The office of chairman will be discontinued.

George V. Myers will continue as an executive vice president and will coordinate activities of four affiliated companies, **Service Pipe Line Company, Pan American Petroleum Corporation, Indiana Oil Purchasing Company** and **Amoco Trading Corporation.** Under Myers direction, **John R. Evans** will be general manager of production, responsible for coordinating crude oil production, pipe line and purchasing activities in North America and **F. H. Blunck,** coordinator of foreign operations, both now of Standard Oil.

Standard Oil Company will become exclusively a parent company January 1, subject to Internal Revenue Service clearance and to stockholder approval. **American Oil Company** will become the single product research, refining, transportation and marketing subsidiary of Standard Oil.

Texas Gas Transmission Corporation announces the appointment of **Monty G. Martin** as manager, gas reserves. Formerly chief geologist, Martin's new duties include the estimation of all the company's reserves, estimation of gas reserves under proposed contracts and the furnishing of pertinent data and information concerning drilling activity in the company's gas supply area.

Monty G. Martin

He has been with the company for over eight years and has been chief geologist since 1954. Prior to joining Texas Gas he had been associated with Southwest Natural Production Company.

Stephen D. Bechtel, Sr., has been selected as the 1961 recepient of the John Fritz Medal, awarded annually for notable scientific or industrial achievement in the engineering profession.

Sponsored by the American Society of Civil Engineers, American Institute of Mining Engineers, American Society of Mechanical Engineers, American Institute of Electrical Engineers and American Institute of Chemical Engineers, the award will be presented at next year's meeting of the ASCE in October in Boston.

Bechtel, who has headed the **Bechtel Corporation** for 42 years, receives the highest honors established in 1902 to perpetuate the memory of the late John Fritz' achievements in industrial progress. Bechtel was also named to receive the annual National Transportation Award (PIPE LINE INDUSTRY, September 1960, Page 102).

Transcontinental Gas Pipe Line Corporation announces two promotions in the Measurement Department. **E. N. Armstrong,** formerly superintendent of measurement, becomes director of measurement research. **W. W. Cofield,** who has been serving as assistant superintendent, becomes superintendent of measurement, succeeding Armstrong.

Armstrong has been with the company since 1949. He worked for Fish Constructors, Inc., Tennessee Gas Transmission Company, Shamrock Oil and Gas Corporation, Bureau of Mines, Illinois Oil Co. and Cities Service Company. Cofield joined the company in 1950 after graduation from college.

David G. Beerbower has been elected secretary of **Union Texas Natural Gas Corporation.** He joined the company in 1957 as an attorney in the Land Department.

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Northern Natural Gas Company has announced the promotions and transfers of the following men: **David Lage, Jr.**, Omaha, Neb., promoted to supervisor of clerical service; **Harold Barrett**, Omaha, Neb., to supervisor of operations, **Wayne Brown**, Hobbs, N. M., to gas engineer and transferred to the Omaha office; **Orville Bruce Jones**, Omaha, promoted to well test engineer and transferred to Liberal, Kan., and **James Welsch**, Liberal, Kan., transferred to Hobbs, N. M., as well test engineer.

Lage has been with the company since 1950, and had been a clerk in the Gas Supply Department prior to his promotion. Barrett joined Northern on November 6, 1947, and served in various jobs at Skellytown, Texas, and Hobbs, before being transferred to Omaha as a gas engineer in 1956. Brown has been with Northern since 1947, and has served at Hugoton, Kan., Guymon, Okla., and Hobbs, N. M. He had been a well test engineer at Hobbs since 1958. Jones joined the company in 1951, as a field clerk in Hugoton. He had been a clerk in the Omaha office prior to this promotion. Welsch began his career with Northern in 1950, as a field draftsman at Garden City, Kan.

Deaths

Charles H. Lane, 74, director of Gulf Publishing Company since 1918, and retired independent oil operator, died in his home in Houston August 13. Lane was an organizer of the E. F. Simms and Co., and studied law in the firm of Hunt and Meyers before accepting a position with Producers Oil Co. which is now Texaco Inc.

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WHO'S MEETING WHERE

October

INGAA, annual meeting, Fontainebleau Hotel, Miami Beach, Fla., Oct. 2-4.

Gas Measurement Institute, National Guard Armory, Liberal, Kan., October 4-5.

NACE, 10th annual Western Region Conference, Sheraton-Palace Hotel, San Francisco, October 6-7.

NACE, Southeast Region Conference, Dinkler-Plaza Hotel, Atlanta, Ga., October 6-8.

AGA, annual convention, Atlantic City, N. J., October 10-12.

NACE, Northeast Region Conference, Prichard Hotel, Huntington, W. Va., Oct. 11-14.

California Natural Gasoline Association, fall meeting, Hotel Miramar, Santa Monica, Calif., 13-14.

ASME-ASLE, lubrication conference, Statler Hilton, Boston, October 17-19.

NACE, North Central Region Conference, Pfister Hotel, Milwaukee, October 19-20.

Independent Petroleum Association, annual meeting, Statler Hilton Hotel, Dallas, Texas, October 23-25.

NACE, South Central Region Conference, Mayo Hotel, Tulsa, October 25-27.

NGAA, Southern Regional Meeting, Carlton Hotel, Tyler, Texas, October 28.

November

NACE, Canadian Region Eastern meeting, Sheraton Mount Royal Hotel, Montreal, Quebec, November 14-16.

API, annual meeting, Palmer House Conrad Hilton and Congress Hotels, Chicago, November 14-16

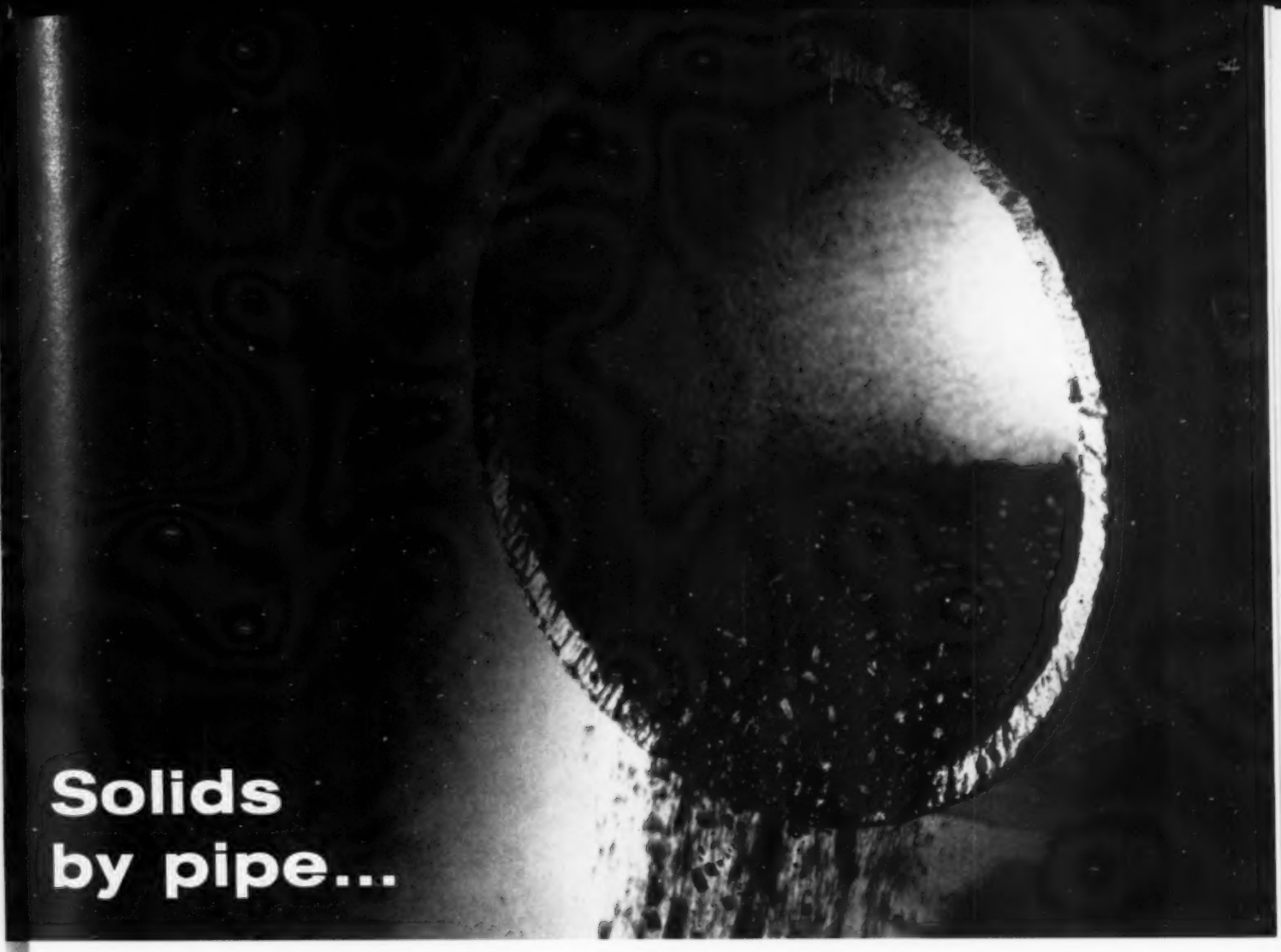
Natural Gas Pipeline Institute, court room, Court House, Liberal, Kan., November 15-16.

NGAA, Panhandle Plains Regional meeting, Herring Hotel, Amarillo, Texas, November 18.

ASME, winter annual meeting, Statler Hilton, New York, November 27, December 2.

January

Pipe Line Contractors Association, annual meeting, Fairmont and Mark Hopkins Hotels, San Francisco, January 15-18.



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NGAA, Gulf Coast Regional meeting, Robert Driscoll Hotel, Corpus Christi, Texas, January 20.

March

ASME, Gas Turbine Power Division, co-sponsored by the Department of Defense, sixth annual conference and exhibit, Shoreham Hotel, Washington, D. C., March 5-9.

NACE, seventeenth annual conference, Hotel Statler, Buffalo, N. Y., March 13-17.

New England Gas Association, annual meeting, Hotel Statler, Boston, March 15-17.

Mid-West Gas Association, annual meeting, Sheraton-Fontenelle Hotel, Omaha, Neb., March 27-29.

April

PIEA-PESA, annual meeting, Galveston, Texas, April 11-13.

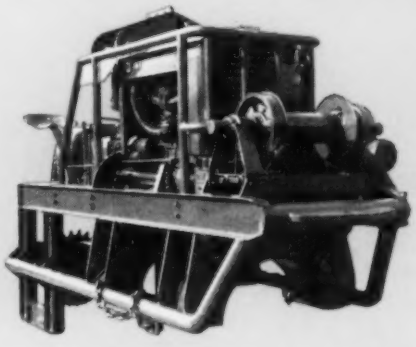
Southern Gas Association, annual convention, New Orleans, April 24-26.

API, Division of Transportation, annual meeting, Chase Park Plaza Hotel, St. Louis, Mo., April 26-28.

May

AGA, Transmission Section, annual meeting, Brown Palace, Denver, May 25-26.

C•R•C ROAD BORING MACHINES

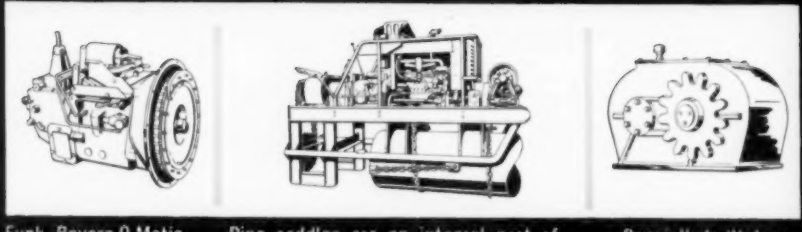


GIVE YOU MORE PROFIT PER JOB!

THESE EXCLUSIVE C·R·C FEATURES MEAN MORE FOOTAGE PER DAY: Faster Hook-Up • Easier Handling • Balance Selector Lifting Eyes • "Unitized" Design For Rugged Dependability—Minimum Maintenance.

C·R·C Road Boring Machines are available in 30" and 42" models.

IMPROVED ENGINEERING AND DESIGN FEATURES FIT THE NEEDS OF THE JOB TO BE DONE!



Funk Revers-O-Matic Drive gives a smooth, shock-free drive, eliminates stalling and lugging.

Pipe saddles are an integral part of "Unitized" frame, adapted to casing with liners, eliminating costly extra parts. Adjustable pull-hooks eliminate need for welding on pusher lugs.

Specially-built heavy duty speed reduction unit.

For faster, more efficient pipeline crossings, put a C·R·C Road Boring Machine on your spread. Write for detailed brochure.

SERVING PIPELINERS SINCE 1933

CRUTCHER·ROLFS·CUMMINGS, INC.

Home Office: Houston, Texas, Box 2073, OVerland 6-4301

Export Office: D. T. O'Conner, Inc., 500 Fifth Avenue, New York 36, N. Y., BRyant 9-2236

In Canada: Canadian Equipment Sales & Service Co., Ltd., 7310 99th St., Edmonton, Alberta, Canada

NEW BOOKS

Gas Rate Fundamentals, American Gas Association, 420 Lexington Ave., New York 17, $7.00.

The American Gas Association has made available its Gas Rate Fundamentals. The book, sponsored by the AGA rate committee, is the first thorough presentation of rate fundamentals and practices devoted entirely to the gas industry. It represents a collection of papers prepared by experienced rate men in all segments of the gas industry and edited by the AGA subcommittee on training of rate men.

The 360-page volume, in preparation for more than three years, is intended primarily for on-the-job education of gas company employes and younger men in rate departments. It is also recommended as a reference work for the experienced rate man.

Occupational Outlook Handbook, U. S. Department's Bureau of Labor Statistics, Suite 540, 1371 Peachtree Street, N. E., Atlanta 9, Ga., $4.25.

The best jobs will demand more education and training, according to the U. S. Department of Labor's study on occupational outlook for the 1960s.

Professional and technical occupations are expected to grow most rapidly during the next decade. Scientific and professional fields will expand and prosper for physicists, mathmeticians and engineers.

Probably the fastest growth will come in employment in finance, insurance and real estate, followed by construction, services, trade, communications and public utilities.

Other facts such as training requirements, prospects for employment and advancement and the nature of the work for hundreds of occupations are included in the handbook.

Russian Translation

Several Soviet technical articles and books translated by United States Government agencies have been released for sale to the public through the Office of Technical Services, Business and Defense Services Administration, U.S. Department of Commerce, Washington 25, D.C.

Radioactive Isotopes in the Petroleum Industry, Yu. S. Zaslavskiy and S. E. Kreyn in Nature (Priroda), August 1957, 19 pages, 75 cents, 59-11987.

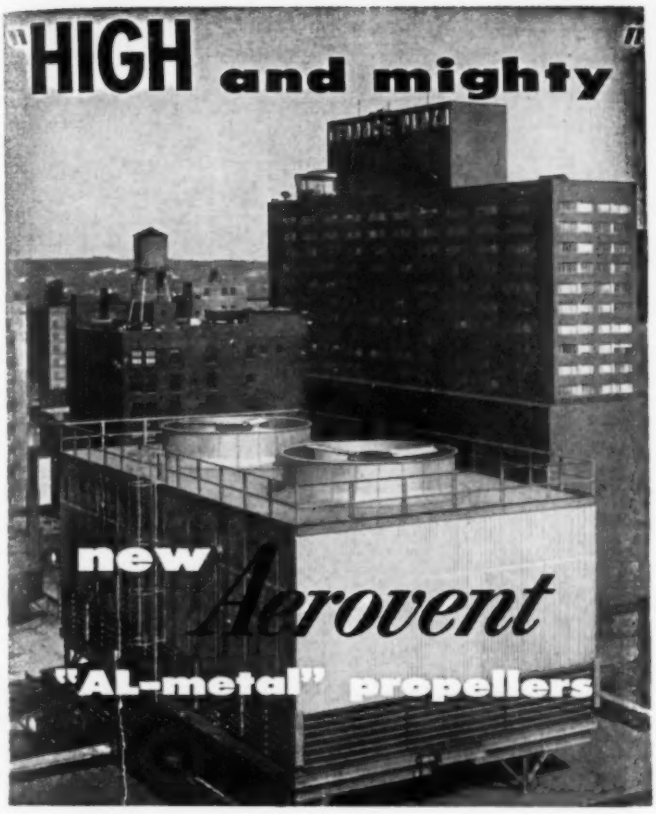
This report explains use of radioactive isotopes for exploration, production and processing of petroleum products. Radiometric prospecting for petroleum deposits and the use of radiometry in oil well studies are also discussed.

Improving the Dependability of Pipe Lines of Hydraulic Systems, from Grazhdanskaya Aviatsiya, 1956, 15 pages, 50 cents, 59-11984.

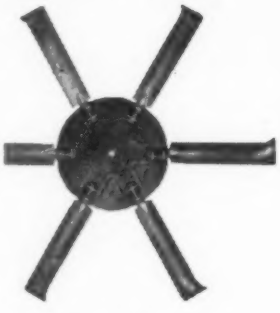
This describes ways of increasing the resistance of hydraulic pipe line systems. Peculiarities of aircraft hydraulic systems are emphasized.

Solid Gasoline, B. I. Losev, Priroda, September, 1958, 17 pages, 50 cents, 59-11999.

Methods of converting solid gasoline into liquid gasoline ready for use with very little loss of quality are described.



move mountains - of AIR!
in towers and exchangers



- Sizes 14′ to 18′
- 4 or 6 blades

Developed originally for the petroleum industry, Aerovent Large-Diameter "Al-metal" Propellers, constructed of tough, durable aluminum alloy, move great quantities of air at high velocities, in heat exchangers and cooling towers. Pictured above are two 4-blade, 16-ft. propellers in a cooling tower installation. These mighty propellers, with adjustable-pitch "Macheta" Airfoil blades, are job-engineered to individual specifications.

Write for free Bulletin 510

DESIGNED FOR DEPENDABLE OPERATION!

Endurance tests, conducted at *3 times* normal loading prove the ability of these new large-diameter propellers to withstand severe punishment. Heavy-duty cast steel hubs offer maximum resistance to stresses. Angle settings for each operating requirement, and appropriate alternate settings, assure accurate pitch for any predetermined performance which may be required. 54″ to 144″ now available in Adjustable Pitch Models.

REFINERIES, pumping stations, industrial plants and commercial buildings use Aerovent "Al-metal" Propellers in major air-moving applications.

Aerovent FAN COMPANY, INC.
LARGE PROPELLER DIVISION
304 Wright Bldg.
TULSA 3, OKLA.
Main Office and Factory
PIQUA, OHIO

A sleeve, raised and lowered within a non-magnetic tube, attracts or releases an Alnico magnet attached to a mercury switch. Basically, this is Magnetrol.

MAGNETROL

AS DEPENDABLE AS MAGNETIC FORCE ITSELF

● No matter how specialized the liquid level control application, adapting Magnetrol to meet it presents no problem. Whether it's for high pressures, high temperatures, corrosive liquids or any other condition, a few "standard" modifications and the job is done! Operation is so simple no changes in basic design are needed. That's why Magnetrol "fits" practically any application — why "specials" are so often standard with us.

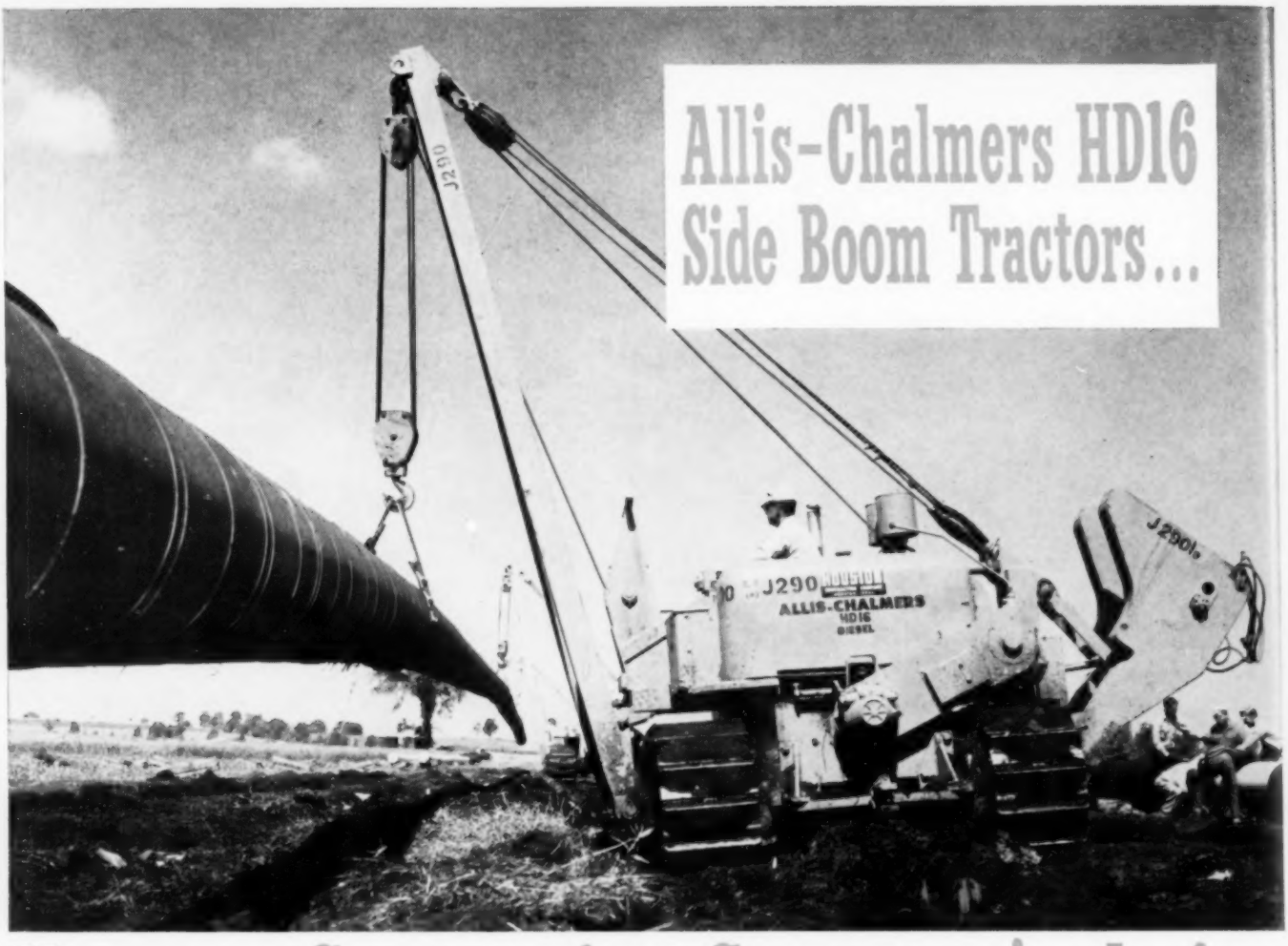
Because of the utter simplicity and dependability of its magnetic principle, Magnetrol has *infinite operating life.* There are no wearing parts to get out of order.

Magnetrols are available for controlling level changes from .0025-in. to 150-ft., with single or multi-stage switching. Our experienced engineering staff is at your service.

MAGNETROL, Inc.

WHY NOT MAIL THE COUPON — NOW

MAGNETROL, Inc., 2128 S. Marshall Blvd., Chicago 23, Illinois
Please send me catalog data and full information on Magnetrol Liquid Level Controls.
Name_____
Company_____
Address_____
City_____ Zone____ State_____



Houston Contracting Company's choice for 24" Michigan-Wisconsin Pipe Line

There's a good reason for one of the leading pipeline construction company's selecting Allis-Chalmers for their job. First of all, the powerful high-clearance HD-16 is the best balanced tractor on the market which means more efficient operation in hilly and boggy terrain. The famous Allis-Chalmers torque converter is standard equipment in the HD-16 FC Boom Tractor and this means easy operation. And when you're laying pipe in hilly and mountainous terrain the Allis-Chalmers HD-16 has plenty of power—not only to pick up a load but to carry it as well. Still another feature of the HD-16 is the Decelerator foot throttle which frees the operator's hands so he can handle the side boom. The HD-16 costs surprisingly little to operate. Its 150 net hp engine can save you up to 27% in fuel over other tractors of comparable size. Permanently lubricated rollers, heavy duty, extra tough tracks keep maintenance costs low on the HD-16.

Call Brown-Fogle and ask to have a demonstration of the HD-16 soon.

BROWN-FOGLE EQUIPMENT CO.

8821 ALMEDA ROAD • P. O. BOX 14207

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What's Happening among SERVICE and SUPPLY MEN

Crane Co. Holds Wholesaler Distributor Meeting

Crane Co. recently held its first meeting of the wholesaler-distributor advisory council. The conference enabled distributors to review problems and determine ways to improve service and sales. Advisory Council members meeting with Crane officials at Chicago: (left to right, back row) G. F. Burley, W. A. Songer, W. D. LaRue, W. W. Kovalick, all of Crane Co.; R. C. Williams, Gulf Supply Co., Inc.; C. H. Lovelace, Crane Co.; A. J. dePalma, Crane & Ordway Co.; Jack Gallicies, Burns Suppy Co.; E. W. Breese, Hajoca Corp.; J. P. Magos, Crane Co. Front row, W. B. Christie, Ben Williamson & Co.; E. G. Habenicht, Crane Co.; E. O. Garrett, Tucson Pipe & Supply Co.; Thomas Floro, Columbia Pipe & Supply Co.; F. V. Keenan, Keenan Pipe & Supply Co.; B. W. Vinson, Vinson Supply Co.; Leonard Reel, Reel Pipe & Valve Co.; H. F. Tapke, Crane Supply Co.; Ted Olson, Crane Co.; S. C. Olin, Crane Co.

Southwestern Pipe Appoints Dallas Sales Representative

Clayton A. Smith has been appointed Dallas sales representative for Southwestern Pipe, Inc. He will serve the area of Dallas, Fort Worth, Wichita Falls, Texas, Shreveport, La., and El Dorado, Ark.

Smith has been with an oil field supply firm in Borger and Pampa, Texas, more recently in the Purchasing Department of Seaboard Oil Company. In 1958 he became purchasing agent of Stekoll Petroleum Company in Dallas. His office in Dallas will be in the Fidelity Union Life Building.

Youngstown Sheet and Tube Names Dr. Lander Assistant Research Head

Dr. Horace N. Lander has been named assistant director of research for the Youngstown Sheet and Tube Company. He was formerly research supervisor for Jones & Laughlin Steel Corporation and also had worked with General Electric Company. He is a member of the American Institute of Mining, Metallurgical and Petroleum Engineers, American Society for Metals and American Ceramics Society.

He will be in charge of the company's specialized research in basic iron and steel making processes.

Allis-Chalmers Control Department Names R. C. Brown Manager of Sales

R. C. Brown has been named manager of sales for Allis-Chalmers Manufacturing Company Control Department. He succeeds G. G. Brooks, who has been transferred to Allis-Chalmers associate company, Consolidated Systems Corporation, where he will be in charge of industrial systems.

W. G. Williams replaces Brown as manager of Allis-Chalmers rectifier section. Brown has been with the company since 1946. Brooks has been supervisory engineer for standard starters from 1955 to 1958, when he became manager of product sales in the Control Department. Williams was sales engineer in the Industrial Systems Department and in the rectifier section before becoming engineer-in-charge of induction and dielectric heating sales in 1957, and manager of product sales in the rectifier section early this year.

Chicago Pneumatic Tool Company Names Kacmarik General Manager

John Kacmarik has been appointed general manager of Chicago Pneumatic Tool Company's plant at Franklin, Pa. He will succeed H. E. Moore, who is retiring after 41 years of service.

John Kacmarik

Kacmarik will be responsible for all activities at the plant, which is the company's engineering and production center for air and gas compressors; diesel, gas and dual fuel engines, and Reichdrill drilling rigs. He has been with Chicago Pneumatic since 1932. Moore started with the company in 1919.

C. Lee Cook Company Names Williams Tulsa Representative

Charles E. Williams has been named Tulsa Mid-Continent Division sales representative for C. Lee Cook Company. Williams formerly was lubrication engineer with the Gulf Oil Corporation.

Robert L. Dietrichson Named Veeco Vacuum West Coast Manager

Robert L. Dietrichson has been appointed West Coast regional manager of Veeco Vacuum Corp., with offices in Redwood City, Calif. He has been with the company since 1956. After serving in the Engineering Services Department he was transferred to the Sales Department.

Nordberg Mfg. Co. Establishes New Kansas City Headquarters

A new Kansas City headquarters has been established by Nordberg Mfg. Co. to provide better service for users of Nordberg engines. New offices are located at 5812 Roeland Drive, Mission, Kan.

Caterpillar Tractor Co. Names C. B. Leber Advertising Manager

Charles B. Leber has been named advertising manager of Caterpillar Tractor Co. succeeding Burt M. Powell who has retired. Powell has been advertising manager since 1953.

Replacing Leber as manager of the Sales Division of the Defense Products Department is Frank S. Foster. Leber joined the company in 1947, and has held various supervisory positions in sales work including district representative, assistant sales manager and sales training manager. Foster has been with the company since 1945, and has served a variety of assignments in the Sales Department.

Max E. Landry Named Barry Pump Co. Agency

Max E. Landry, Inc., Cincinnati, has been appointed exclusive sales agency for the Barry V60 quadruple plunger pumps manufactured by W. R. Barry Pump Co., Tulsa.

NEW compressor-carrying steps-up "tack" and "hot-pass"

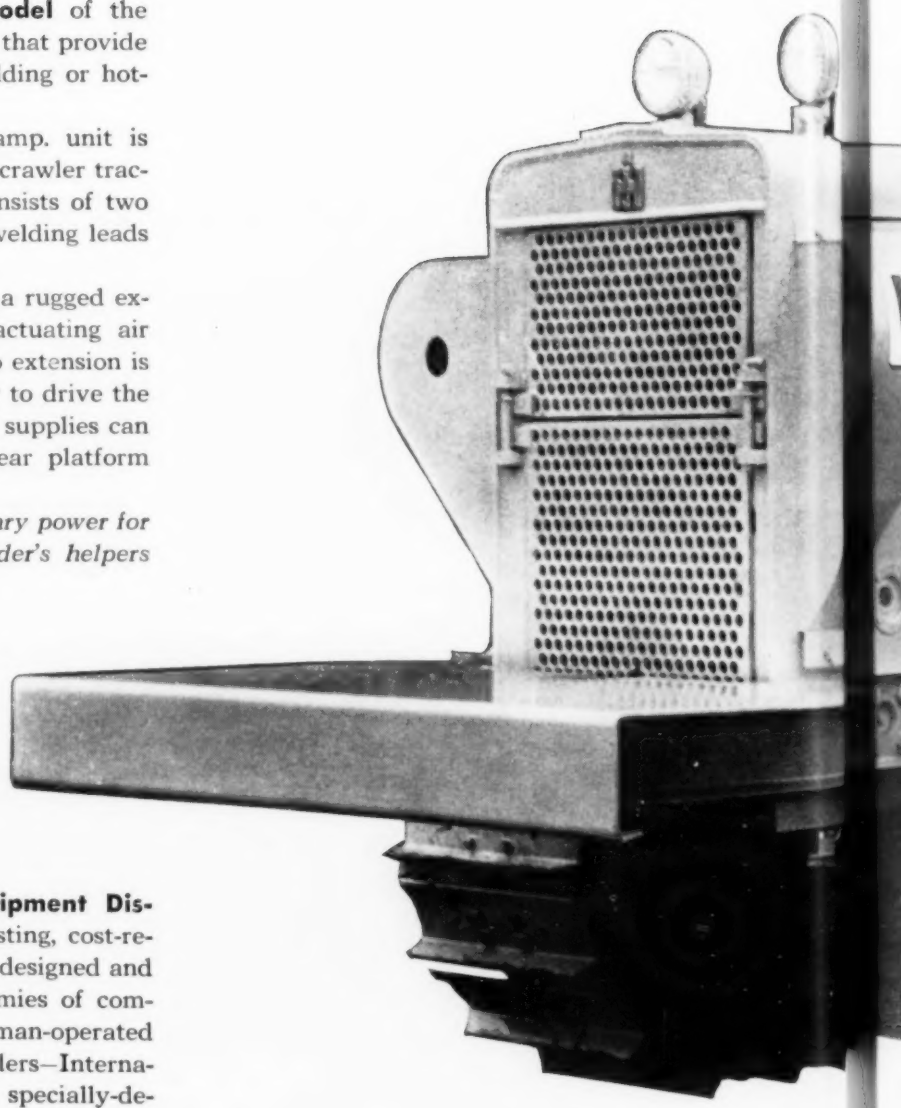
Now, International presents the 1961 model of the TD-15 Pay welder—with major improvements that provide greater efficiency than ever for your tack-welding or hot-pass welding crews.

This factory-engineered, high-output 325-amp. unit is powered and carried by the 6-cylinder TD-15 crawler tractor equipped to produce 120 int. hp. Unit consists of two Lincoln dual welders (4 welders), with four welding leads —V-belt driven from front pto.

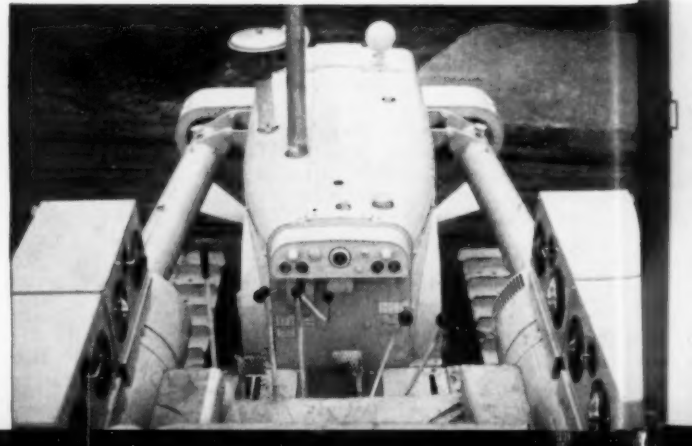
In addition, the new Pay welder gives you a rugged extension platform for mounting your clamp-actuating air compressor. And as standard equipment, a pto extension is provided on which to mount the V-belt pulley to drive the compressor. Even your extra pipe clamps and supplies can be toted by the Pay welder on the large rear platform which is standard equipment!

You save the cost of skid mounts and auxiliary power for welders and compressor. Also, no extra welder's helpers are needed!

Self-contained and self-propelled, this spread-speeding, go-anywhere unit with 74-inch gauge tracks has the ground-hugging stability to operate on all terrain. For maximum flotation on swampy right-of-way, use maximum width (24-inch) track shoes. Positive sealing thoroughly protects vital working parts from dirt and moisture.



See your International Construction Equipment Distributor—see what it means in efficiency-boosting, cost-reducing performance to depend on this factory-designed and engineered welding unit. Measure the economies of combining four welders and compressor in a one-man-operated rig. Compare plus advantages like Dura-Rollers—International's 1,000-hr. lube interval track rollers, specially-developed to meet "eat 'em alive" pipelining conditions. Ask for a TD-15 Pay welder demonstration.

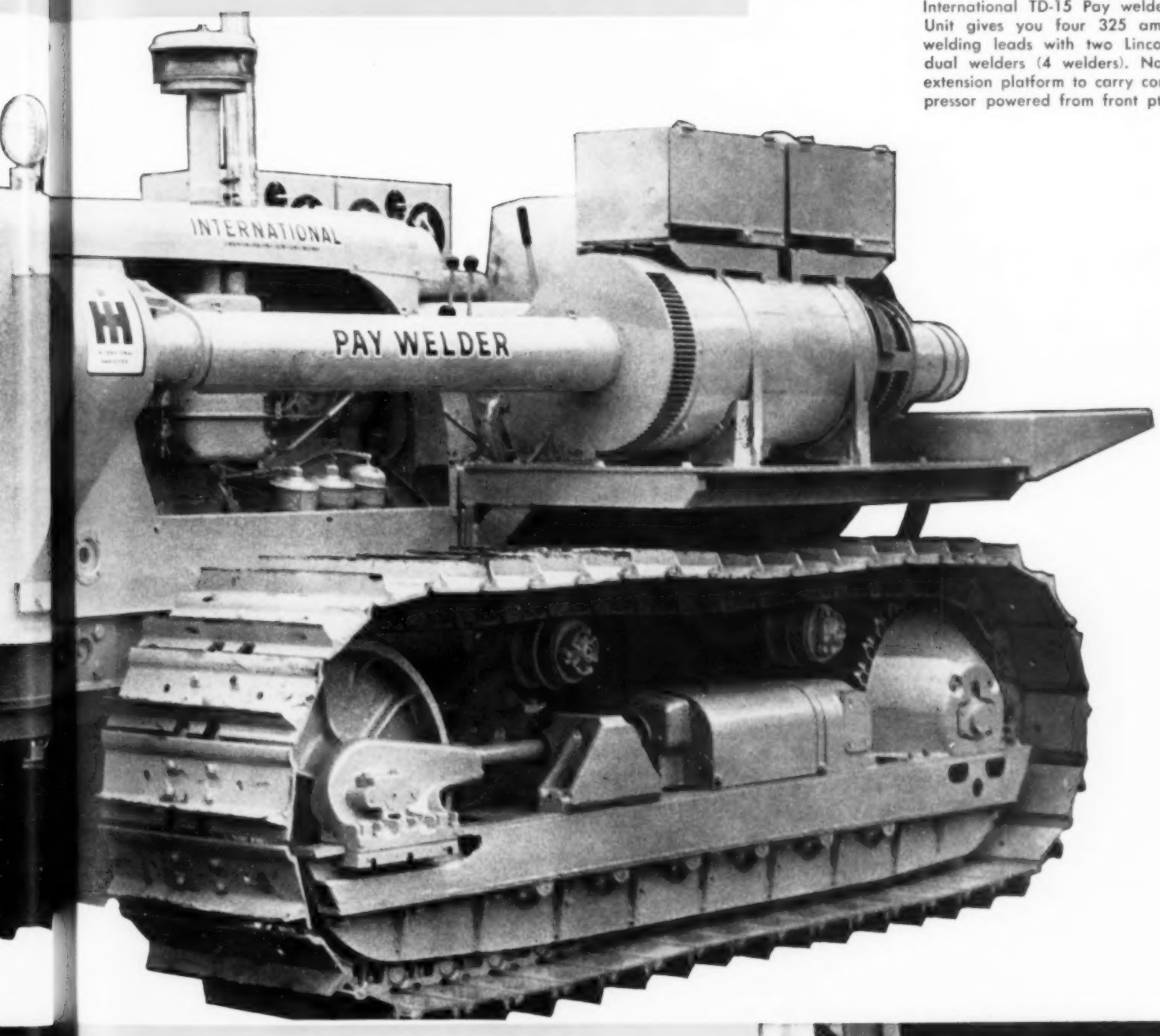


International® *Construction Equipment*

International Harvester Co.,
180 North Michigan Ave., Chicago 1, Illinois
A COMPLETE POWER PACKAGE

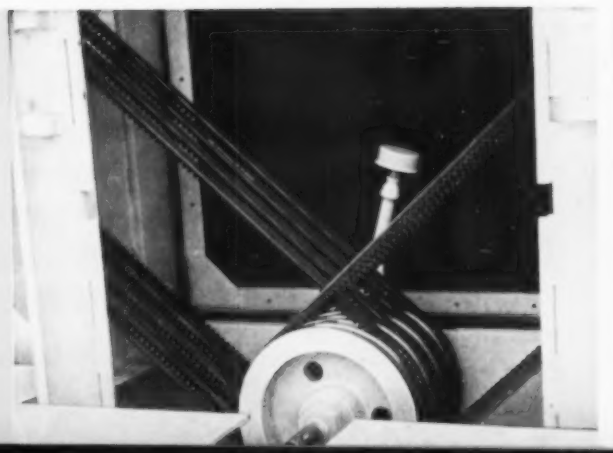
TD-15 PAY® WELDER
welding efficiency

Here's the new completely factory-engineered and built International TD-15 Pay welder. Unit gives you four 325 amp. welding leads with two Lincoln dual welders (4 welders). Note extension platform to carry compressor powered from front pto.

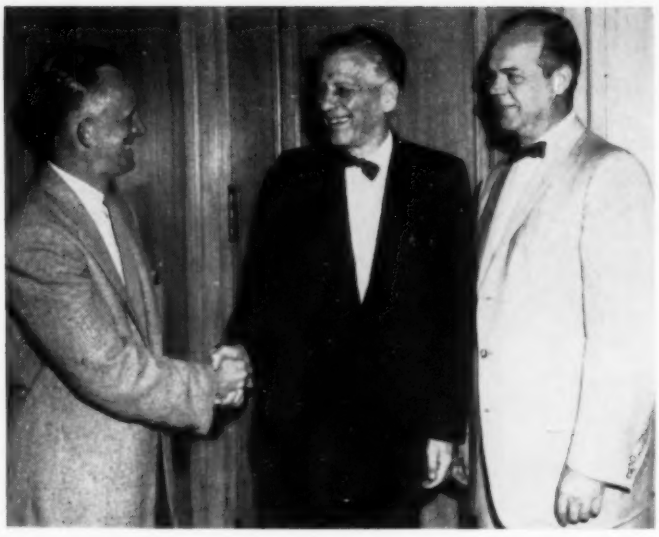


A look into the Pay welder operator's compartment—showing the rugged, engineered appearance of the unit and easy access for the operator. And note the read-easy indicator dials, and reach-easy controls of the tractor and welder components.

Hinged radiator guard is removed to show pto pulley and V-Belt drives of Pay welder generators. Note pto extension to mount additional pulley to drive compressor mounted on front extension platform. Heavy-duty, sealed, dual-race ball bearings carrying the pulleys provide life-prolonging performance protection in the Pay welder.



LESCHEN WIRE PORTER ROPE DIVISION
H. K. PORTER COMPANY, INC.



Case Employe Wins Design Award

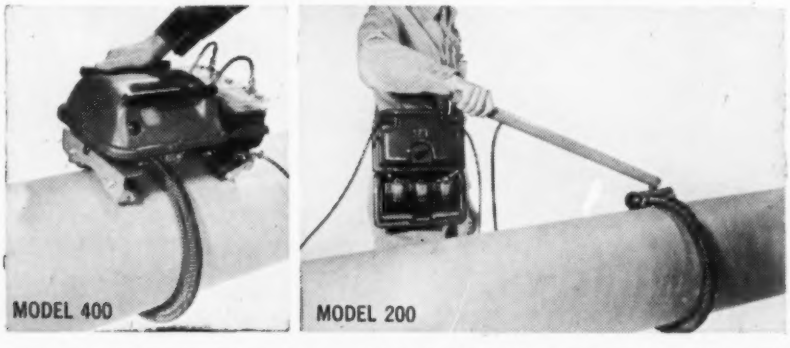
Gordon Kousek, center, of J. I. Case Company is congratulated by Wm. J. Grede, left, president, and James A. Nelson, general manager of Clausen Works, after winning an award from the Gray Iron Founders' Society, Inc. Kousek, value engineer at Clausen Works, won third prize in the national contest for his design of an engine and hydraulic pump support casting.

Oakite Products, Inc., Announces Election of Two Vice Presidents

J. Justin Basch has been elected second vice president and William A. Baltzell as vice president of Oakite Products, Inc. Basch joined the company in 1925 as representative in Pittsburgh. He became Philadelphia division manager in 1930, and has been vice president in charge of marketing since 1958. He will be responsible for the company's marketing and research and product development programs.

Baltzell joined Oakite in 1941. In 1958 he was appointed industrial sales manager, which he continues to hold.

...our SPY HOLIDAY DETECTORS are as near as your telephone—in fact, in emergencies our own plane assures immediate service



Rugged equipment for dependable holiday detection on ¾" to 36" pipe...signal—bell, light and spark...unaffected by dew or frost.

Call, wire or write.

Pipeline Inspection Co., Inc.

2104 WYANDOTTE STREET • KANSAS CITY, MISSOURI

Day Phone: BAltimore 1-6036
Night Phone: HI 4-6745, EM 1-3824

Parsons Company Names J. W. Arnold President

J. W. Arnold has been appointed president of the Parsons Company, a division of Koehring Co. He had been vice president in charge of manufacturing for the Hydraulic Press Manufacturing Co, a Koehring Division, for five years before joining Parsons in 1960.

J. W. Arnold

Prior to that he was general manager of the Erie Engine and Manufacturing Company for four years. He also worked with Ford Motor Co., Clark Equipment Co. and Cadillac Division of General Motors.

Armstrong Cork Company Names R. M. Hill Department Manager

Ralph M. Hill has been named manager of the newly created department in the Industrial Division of Armstrong Cork Company to handle sales of cast urethanes and fluorocarbon materials.

Hill will assume responsibility for sales of fluorocarbon accopacs, sheet materials primarily designed for gasketing and a wide variety of industrial applications where conditions are extreme. J. A. Kelly was appointed technical assistant. J. Mason Smith will continue as sales correspondent for urethane and fluorocarbon sales.

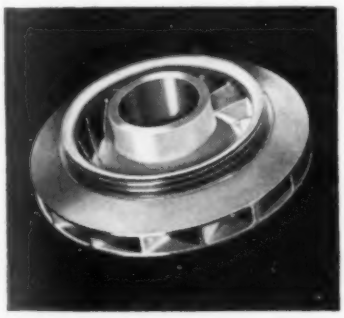
How high speed gas turbines make possible new Solar centrifugal compressor for industrial use

by Leon Wosika, chief of preliminary design
and John Glessner, project engineer
Solar Aircraft Company

The development of the high-speed industrial gas turbine is resulting in improvements in industrial equipment used in conjunction with these prime movers.

A practical centrifugal compressor for the low-volume range is one of the first of these developments.

Traditionally, reciprocating compressors have been used in the range from 500 to 1000 hp when suction pressures are from 200 to 800 psi and volume flows are 100 to 1000 cubic feet per minute at suction temperature and pressure.



It has long been known that a centrifugal compressor would be less expensive to own and operate in this range if high speed drivers were available. For example, direct drive speeds from steam turbines have been limited to 10,000 to 12,000 rpm. When gears are used to obtain high speeds, their cost and complexity has made the compressor-set look less attractive. So, in the range from 100 to 1000 suction cubic feet per minute, a low speed, conventionally designed centrifugal would have to employ compressor rotors of perhaps 15 inches in diameter, and would necessarily have very long, narrow flow passages – resulting in poor efficiency.

Now, however, the availability of industrial high speed drivers, particularly the Solar Saturn T-1000 gas turbine engine, has provided the impetus for Solar to design and build a line of efficient centrifugal compressors for the low volume range. The compressor uses compressor rotors seven inches in diameter. At approximately 20,000 rpm, wheel tip speed is only slightly over 600 feet per second, resulting in low pressure ratios per stage. High rpm and low tip speed plus careful design result in a high efficiency of 70 to 75 per cent.

High efficiency is not the only immediate advantage of Solar's compressor. When it is coupled with a gas turbine in the 500-1000 hp range, no gearbox is necessary since the turbine rotating speeds of about 20,000 rpm match those of the compressor.

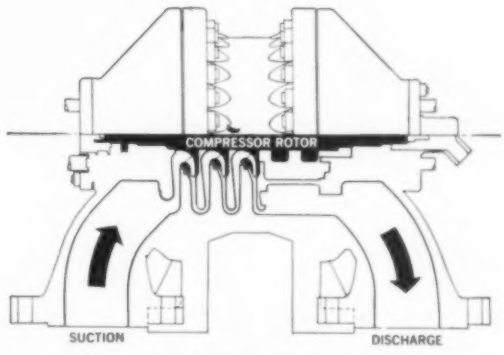
Together, the two machines make a lightweight, compact package – in the case of the Saturn T-1000 turbine, less than 7000 lbs and 300 cubic feet. This factor makes transportation and installation much easier and more economical than with the traditional compressor installation.

This portability makes central maintenance in a convenient, well-equipped shop a practical reality. In addition, the small size, light weight and absence of unbalance forces minimize foundation requirements.

A truly unique feature of the compressor is its modular design – the use of interchangeable staging to accommodate changing pressure and flow characteristics. High efficiency is maintained over the entire range of flows, 100 to 1000 suction cubic feet per minute, by use of pre-engineered, off-the-shelf compressor stages. Each stage is designed for a different flow, but is mechanically interchangeable with any other stage.

Several advantages result from modular design: (1) It reduces costs, mainly through volume production of parts and improved manufacturing methods. (2) It gives the compressor extreme service flexibility by allowing the quick change of stages in the field to accommodate new flows and pressures. (3) It allows quick delivery because all parts may be shipped directly from stock with no factory modifications necessary. (4) It tends to increase reliability and efficiency through repetitive manufacture of standardized parts.

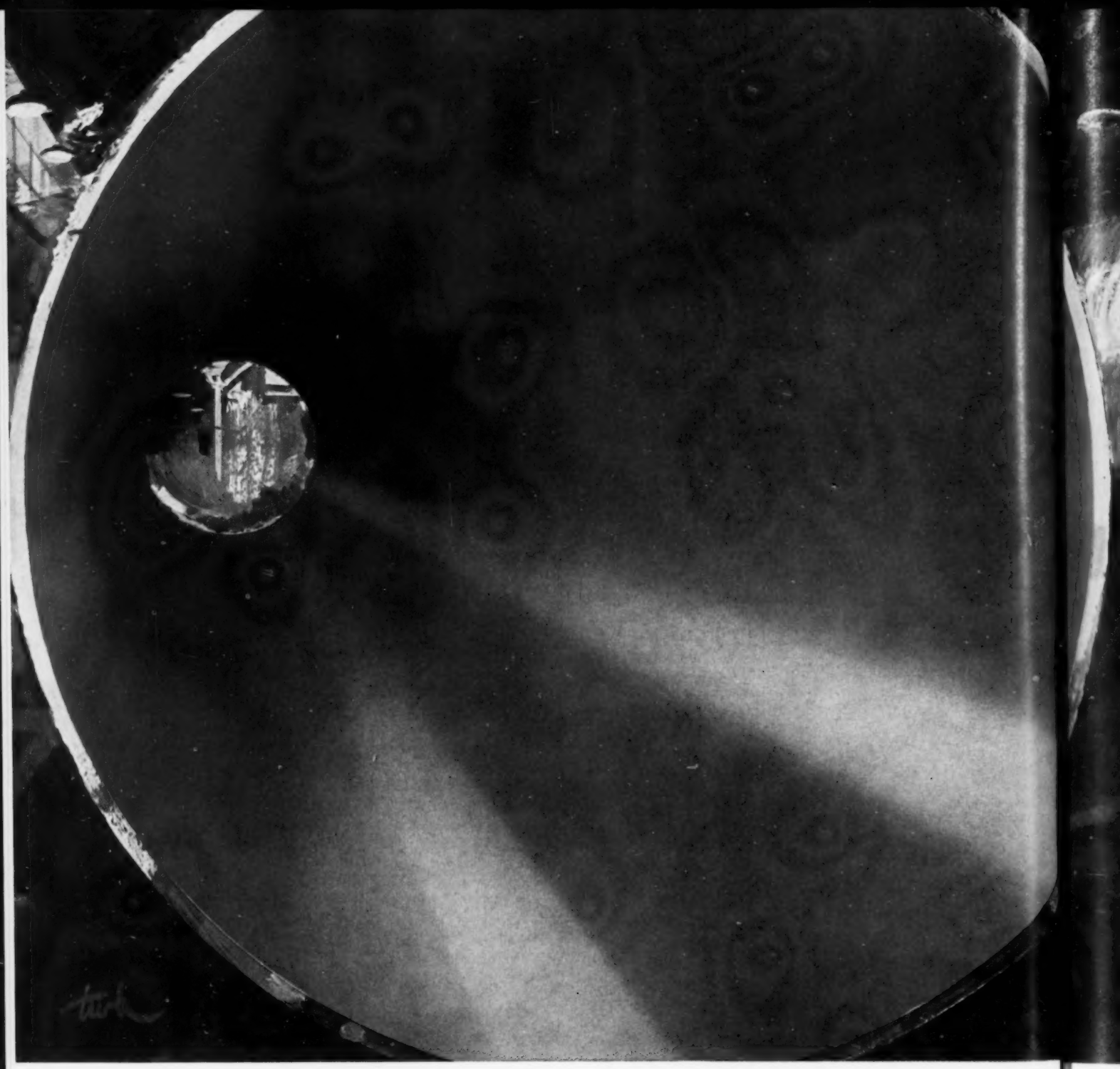
If you wish additional data on either the compressor or the Saturn T-1000 turbine, or both, write Dept. H-166, Solar Aircraft Company, San Diego 12, Calif.



Solar Centrifugal Compressor

SOLAR
AIRCRAFT COMPANY
A subsidiary of International Harvester Company

For more data on advertised products, use Readers' Service Cards, last page.

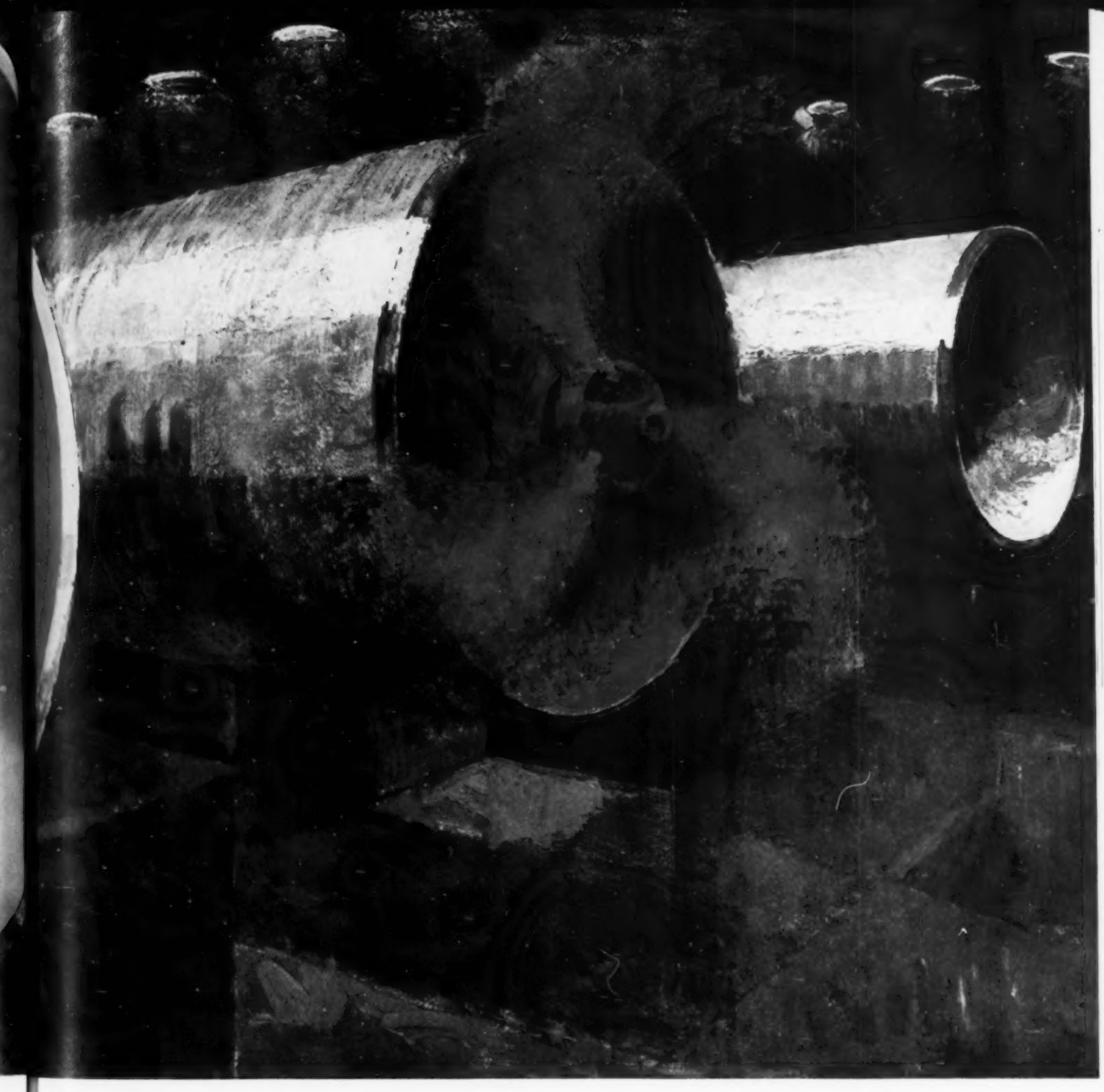


Now USS National Electric Weld line pipe can be internally coated right at the plant

National Tube has erected new buildings and equipment at the Orange, Texas, and McKeesport, Pennsylvania, plants. Your contractor can use these facilities to apply internal epoxy coating for increased flow efficiency and easier cleaning of line pipe.

The coating facilities are all *under roof* to eliminate

This mark tells you a product is made of modern, dependable Steel



weather hazards. No corrosion, water, or dust to complicate coating operations. You get a uniform, high quality internal coating job. We invite you and your coating contractor to visit our plants and see how these facilities can help you. Or write to National Tube, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

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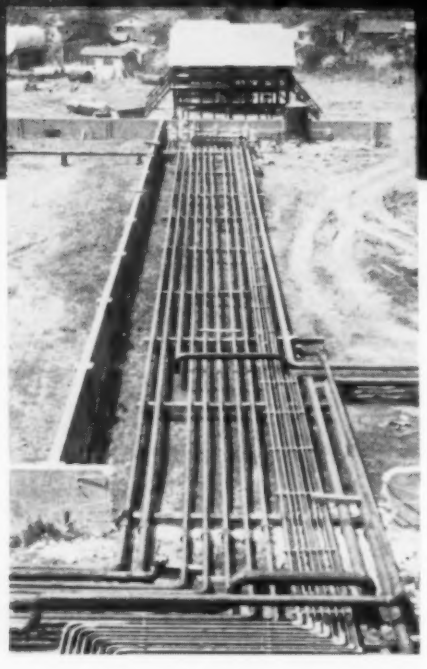
National Tube
Division of
United States Steel

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors
United States Steel Export Company, New York

QUALITY PIPELINES



Another fine service of *LATEX* is the construction of MARINE & PIPELINE TERMINALS. *LATEX* offers personnel skilled in this phase of the industry.

LATEX QUALITY LINE CONSTRUCTION

LATEX offers line construction of the highest caliber. This statement is backed up by more than one quarter century service to the oil and gas industry. Repeating Business has been the keynote to success of this growing company. For your next quality line invite *LATEX*.

REMEMBER, LATEX QUALITY CONSTRUCTION BRINGS REPEAT BUSINESS

LATEX
SERVING 1/4 CENTURY

LATEX CONSTRUCTION COMPANY

P. O. BOX 12128 • ATLANTA 5, GEORGIA • CE 3-9414

Fuller Named Manager of New Position for Wolverine Tube

Carl T. Fuller has been named to the newly formed post of manager of special product sales for Wolverine Tube, Division of Calumet & Hecla, Inc. He will manage many of the company's latest developments on a national basis.

Fuller joined the company in 1947 as a time study engineer and since then has served in various field sales capacities. Recently he had been sales manager of Chicago district.

Howard Gleason Appointed SIE Vice President-Manufacturing

Howard Gleason has been appointed vice president-manufacturing for Southwestern Industrial Electronics. He had been assistant to the president prior to his promotion. Gleason was with Stromberg-Carlson for 14 years before joining SIE.

He has extensive experience in engineering, marketing and manufacturing.

Kellogg Names Copeland Administrative Service Manager

D. S. Copeland has been promoted to manager of administrative services in the Communications Department at ITT Kellogg. He will direct office and management services, plant protection, travel and reservations services and facilities engineering activities at the Chicago plant.

Copeland has been with Kellogg since 1958. He has advanced from assistant contract administrator through contract administrator, program status control manager, manager of the Program Status Department to his present assignment.

Robb W. James Appointed Union Switch General Manager

Robb W. James has been named general manager of Union Switch & Signal Division, Westinghouse Air Brake Co. to succeed A. M. Wiggins. Wiggins, vice president and general manager retired after 27 years service with the company. He served in various capacities and was named vice president in 1949.

Robb W. James

James formerly was executive vice president of the National Pneumatic Co., Inc., and Holtzer-Cabot Electric Motor and Telephone Divisions in Boston, Mass.

Browning-Ferris Machinery Promotes Carl Arnold

Carl B. Arnold, territorial salesman for Browning-Ferris Machinery Company, has been made pipe line contractor representative, with headquarters in Dallas. Arnold worked with Magnolia Pipe Line Company and a pipe line contractor before joining Browning-Ferris.

Case Company Announces Several Appointments

J. I. Case Company has announced several appointments. Carl vonLinsowe has been named director of engineering—industrial products; Frank Lipari becomes manager—the Stockton plant, and T. J. Garbeff was named manager of the newly-established central parts division.

For the past three years VonLinsowe has been manager of engineering of the Churubusco, Ind. Works. Prior to joining Case, he was with the Allison Division of General Motors. Lipari succeeds Garbeff. He has been with the company since 1947. Previously Lipari was employed with an auto supply firm. Garbeff has been with the company since 1949. He became assistant manager at Stockton in 1957, and was made manager in 1958.

General Electric Company Promotes Edmund K. Nock

Edmund K. Nock has been appointed manager-marketing of General Electric's Small Steam Turbine Department. Formerly manager of domestic industrial sales of the medium steam turbine, Generator and Gear Department, Nock succeeds Charles B. Seelig, who has been named manager of foreign industrial and utility sales for MSTG&G department at Lynn, Mass.

Nock joined the company in 1948, and in 1957, was appointed manager of industrial sales for Area C and in 1959, was made manager of domestic industrial sales.

Yale & Towne Manufacturing Promotes William D. Black

William D. Black has been named assistant to John A. Baldinger, vice president in charge of domestic and foreign materials handling operations for Yale & Towne Manufacturing Company.

He had been assistant general sales manager of the Automatic Transportation Company in Chicago. He has 15 years experience in the materials handling equipment field. He served 10 years with P. W. Voss and Associates as sales engineer and in 1955 joined Automatic Transportation.

LESCHEN WIRE PORTER ROPE DIVISION
H. K. PORTER COMPANY, INC.

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Black, Electric Resistance Welded Steel Pipe, Double Random Lengths, Plain Ends, Beveled for Welding, API Specification 5L, Grade B, Moody Inspected and Certified.

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■ For sale, rent, or lease: Twelve-inch portable hydraulic dredge, Caterpillar powered. Bid prices given. Sale price $40,000. Half down. Marine Construction Company, 2325 Welch, Houston 19, Texas. JA 3-9020.

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Have you written a book you would like to have published? Do you have an idea or an outline that you would like to talk over with a publisher? Gulf Publishing Company, publishers of World Oil, Petroleum Refiner and Pipe Line Industry magazines, and numerous technical books, is actively seeking trade and technical manuscripts for publication by its rapidly expanding Book Division. For further information write to Manager, Book Publishing, Gulf Publishing Company, P. O. Box 2608, Houston 1, Texas.

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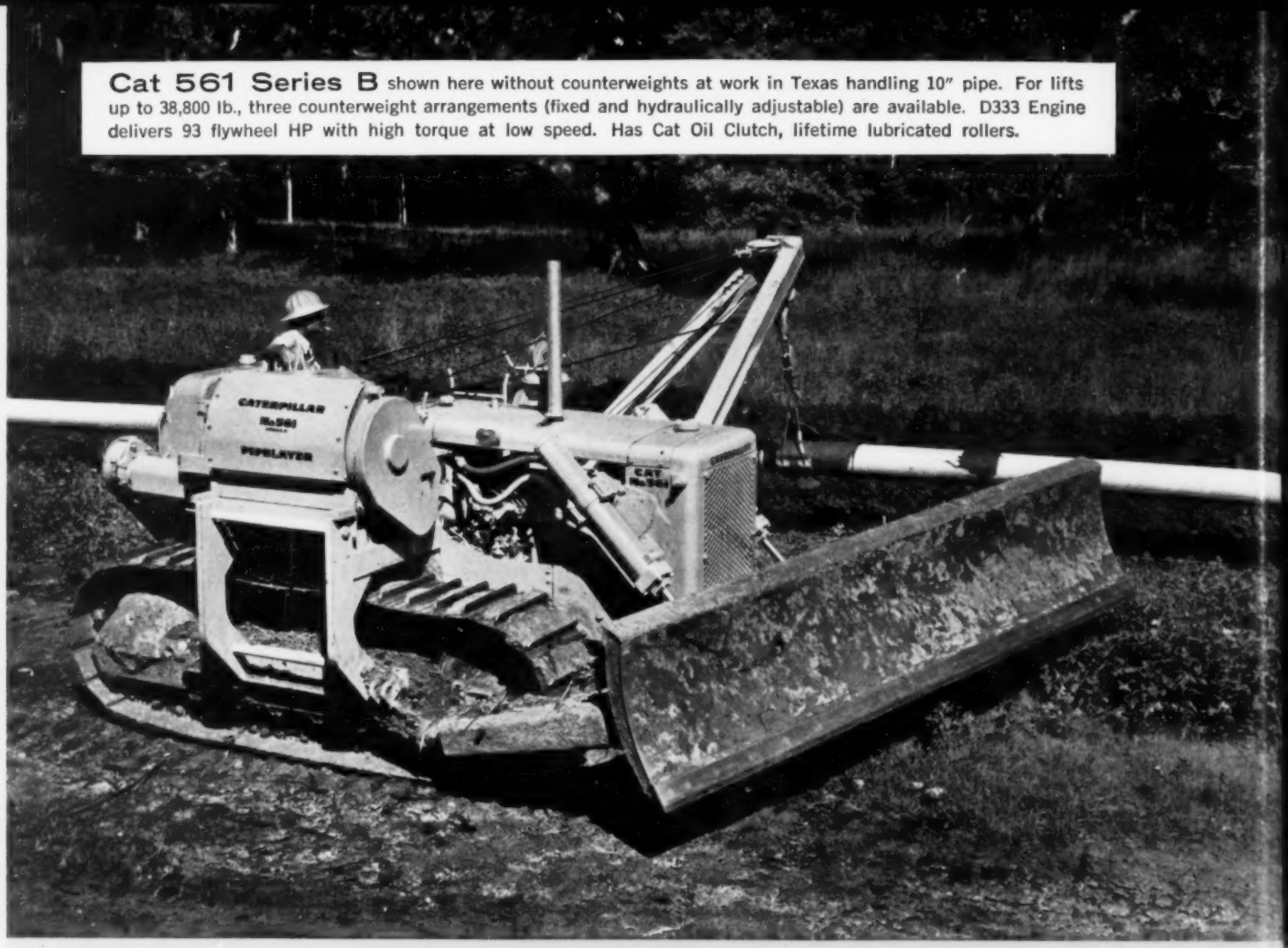
For more data on advertised products, use Readers' Service Cards, last page.



Cat 561 Series B shown here without counterweights at work in Texas handling 10" pipe. For lifts up to 38,800 lb., three counterweight arrangements (fixed and hydraulically adjustable) are available. D333 Engine delivers 93 flywheel HP with high torque at low speed. Has Cat Oil Clutch, lifetime lubricated rollers.

MD7 AND 561 PIPELAYERS

...Caterpillar makes 'em

TAKE THE CAT 561 PIPELAYER—G. W. Townsend Lease Service (Bay City, Texas) used a 561 to lay four miles of 10" and 12" natural gas line for Pan American Petroleum Corp. near Sweeny, Texas. In open country, 600' of pipe was lowered into a 48" by 24" ditch in two hours. In close quarters, an average of 2000' of pipe was lowered in daily.

What do the Townsend people think of the 561? They like the way it handles. They like its balance and the way it responds—fast and accurately. The operator singled out the placement of controls. They're in easy reach, without stretching. Their location permitted him to keep his eyes on the work as he moved along the ditch.

With an angle filler up front, Townsend's 561 takes on extra jobs—backfilling and other utility work. (Another contractor put a No. 6A blade on his 561, uses it for right-of-way clearing. The 561's integral hydraulic system—optional—makes it easy to handle a blade, keeps pump and valves under the hood out of the way.)

All in all, the 561 does the kind of job you expect of Cat Pipelayers. *Dependable*—work done quickly and economically.

OR TAKE THE MD7—Ford, Bacon & Davis Construction Corp., Monroe, La., had about 30 miles of 12" pipe to lay south of Welsh, La., for

Cat MD7 is shown cradling pipe in Louisiana marshland. The Series D MD7 has greater power (140 flywheel HP and 54,200 lb. lifting capacity), improved torque rise (boosts lugging ability by 80%), and there's a new dry-type air cleaner, new, stronger final drives, and many other advantages to boost production and lower costs.

to make money for you

the Louisiana Pipeline Company. The route met an average of three irrigation canals per mile, in addition to Louisiana bayous and swamps. Even so, with three new Cat MD7 Pipelayers in the spread, 4000′ to 5000′ were laid every day.

The MD7's seven-roller track frame and 22″ track shoes give the new Cat Pipelayer exceptional stability and flotation needed in swamps and bayous. No wonder, then, that Ford, Bacon & Davis are pleased with the performance of the new MD7s. They bought them for high production under tough conditions. And that's what they're getting.

These new Cat Pipelayers have what it takes to turn in performance records even better than previous models. Extra production slashes operating and maintenance costs . . . see your Caterpillar Dealer for the whole story on the new pipelayers. Ask for an on-the-job demonstration.

Caterpillar Tractor Co., General Offices, Peoria, Illinois, U.S.A.

CATERPILLAR

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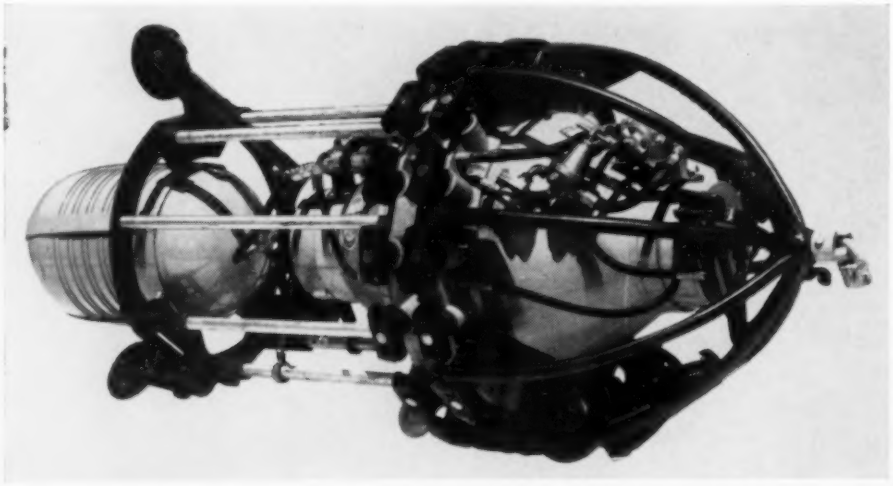
MODERN, HEAVY-DUTY PIPELAYERS FOR THE HARD WORK

What's New in EQUIPMENT



Line-Up Clamp

A new pneumatic operated, roller type internal line-up clamp has been announced by Crose-Perrault Equipment Corp. The new model is lighter in weight and offers faster, easier line-up.

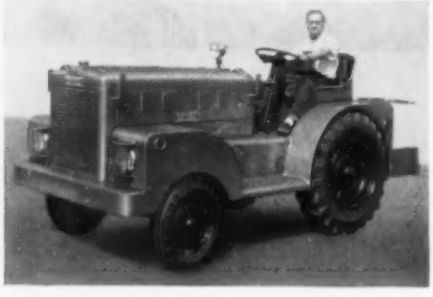
The clamp is equipped with double rollers for more contact points and to eliminate friction between clamp and pipe. Individually operated pneumatic heads bring distorted or "out-of-round" pipe into line, align pipe joints center to center, distribute any pipe diameter differences uniformly around the circumference of pipe—to eliminate "high-low"—and automatically compensate for variations in wall thickness.

A large diameter ball bearing wheel allows the line-up clamp to pass through pipe with ease. It is available with double rollers or conventional studs. For internally coated pipe, plastic wheels are furnished. Also a self-propelled model is available upon request.

The clamp is available in four sizes to handle pipe ranging from 20 inches through 36 inches. Recommended operating air pressure is 150-160-psi with air compressor sized to deliver 5-7½ cu. ft. per minute.

(This item supplements Crose-Perrault Equipment Corp. data on pages 116-117 of the Pipe Line Catalog, Third Revision.)

For more data, circle **No. E1** on Readers' Service Card, last page this issue.



Mobile Welder

A self-contained, self-propelled welding unit, with engine directly coupled to the generator, has been introduced by Hobart Brothers Co. Larger wheels in the rear with ground gripper tires, implement type tires in front, and greatly increased ground clearance at both axles improve mobility of the unit over previous models.

It is designed to provide a mobile self-propelled welding unit for installations in which welding applications occur at widely separate points. With a towing capacity rated at 2,000 pounds draw-bar pull, it can tow other equipment or material to the job. A 400- amp model is powered by a Chrysler 6-cylinder industrial engine and the 600-amp model is driven by a Chrysler V8-cylinder industrial engine. In addition to welding power, the Weldmobile can supply up to one kilowatt (110 volts DC) auxiliary power for operating lights and electric motor powered equipment. Two wells and brackets are located at the rear for acetylene and oxygen tanks.

For more data, circle **No. E2** on Readers' Service Card, last page this issue.

Digital Computer System

General Precision, Inc. has developed an advanced process control digital computer system capable of accepting data directly from analog instrumentation and of providing for closed-loop operation. The Libratrol-1000 was designed by the Librascope Division and is based on the application of up-to-date developments in computer technology and is a logical extension of the 500 system.

It is completely transistorized and includes an advanced memory unit, new developments in read and write head design, and a built-in voltage-to-digital converter. The system operates in the serial, binary mode and offers expanded data-handling capabilities because of the 8000-word memory and a new concept in data placement and recovery.

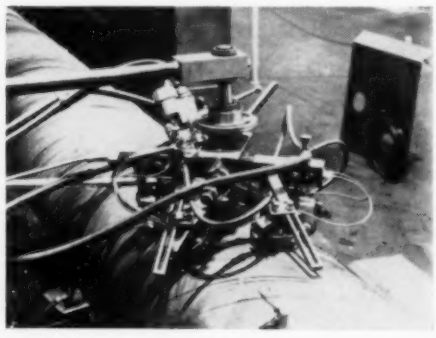
The computer system was designed to operate efficiently in varied environments encountered in many diverse industries. All computing elements, except the input-output devices, are sealed within an air tight enclosure. A refrigeration system within the main cabinet maintains the temperature and atmosphere of the electronic computing equipment at levels conducive to maximum reliability.

The new system features a built-in voltage-to-digital converter. The solid state construction converter is of the successive approximation type and has standard input ranges of 0-1 volt and 0-10 volts.

For more data, circle **No. E3** on Readers' Service Card, last page this issue.

Pipe Testing System

A three dimension nondestructive ultrasonic pipe testing system has been introduced by the Driam Corporation. Four sonic heads beam the waves in manner that results in recorded echoes from defects that lie in any plane. The printing recorder indicates precise area of defect. Paint is automatically sprayed on defective area for visual inspection or X-ray if needed.



The testing head assembly is mounted directly on the pipe as it is being produced. Defects uncovered and identified are pores, longitudinal cracks, transverse cracks, notches, slag streaks, bond failures, etc.

The system is adaptable to the trailer mounted mobile Driam pipe machines, permitting complete testing while the pipe is being produced at the job site.

For more data, circle **No. E4** on Readers' Service Card, last page this issue.

Hydraulic Acoustic Filter

An hydraulic acoustic filter which reduces liquid-borne noises in hydraulic systems, water systems, and electronic cooling systems, has been developed by Pulsation Controls Corporation. Units are applied on high pressure hydraulic systems to eliminate noise from positive displacement pumps and on water systems for eliminating noises caused by centrifugal and turbine type pumps.

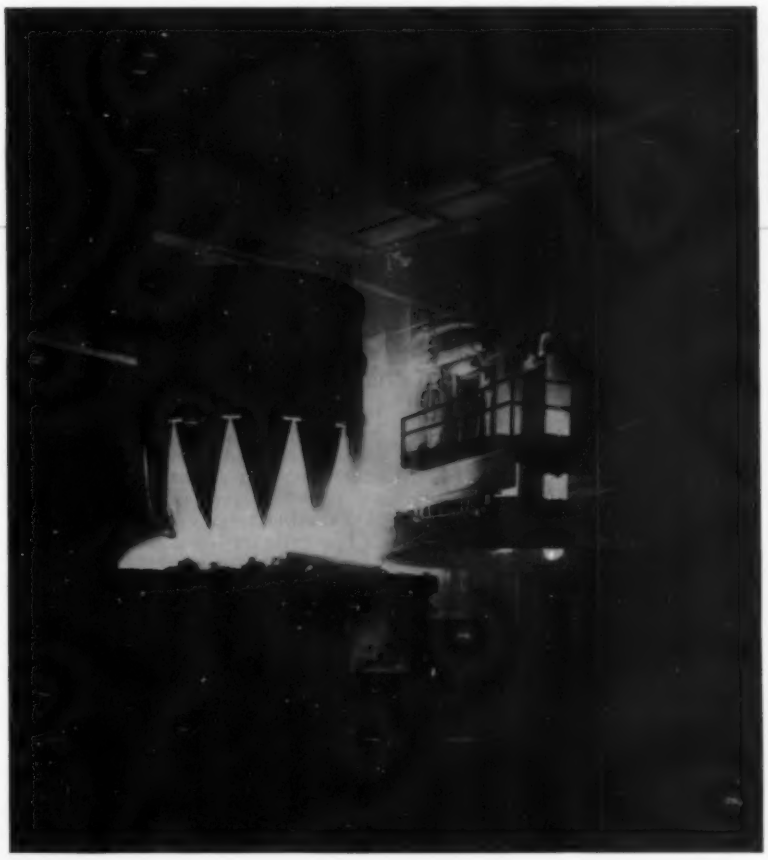
The acoustic low pass interference type filter utilizes a split flow principle to achieve both attenuation and phase cancellation. Units are designed in pressure rating to 8,000 psi and in sizes from 8 to 42 inches in diameter.

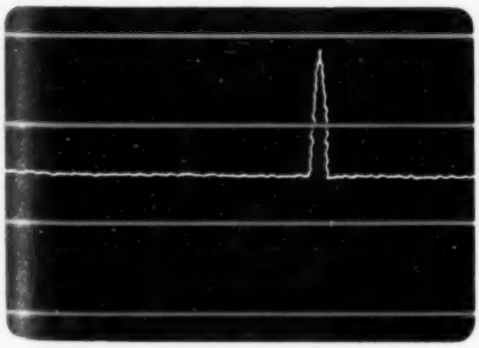
For more data, circle **No. E5** on Readers Service Card, last page this issue.

Acme-Newport

ELECTRIC WELD LINE PIPE

Quality is the First Consideration





Right down the line—from charging electric furnace, through rolling, forming, welding and testing—quality comes first in line pipe manufacture by Acme-Newport.

ELECTRONIC REFLECTOSCOPE is the newest safeguard to quality, scrutinizing miles of pipe for defects not visible to the human eye. This device finds hunting poor, after so many other precautions; yet it is your further assurance of uninterrupted service in the field. Modern facilities and long experience make this basic steel producer a most logical source for your line pipe in 4″ and 6″ sizes, standard or thin wall.

SIZES AND WEIGHTS AVAILABLE

O.D.	Wall	Wt. Per Ft.
4½	.125″	5.84
	.142″	6.61
	.156″	7.25
	.188″	8.64
	.219″	10.00
	.237″	10.79
6⅝	.156″	10.78
	.188″	12.89
	.219″	14.97
	.250″	17.02
	.280″	18.97

Acme-Newport Steel COMPANY

NEWPORT, KENTUCKY

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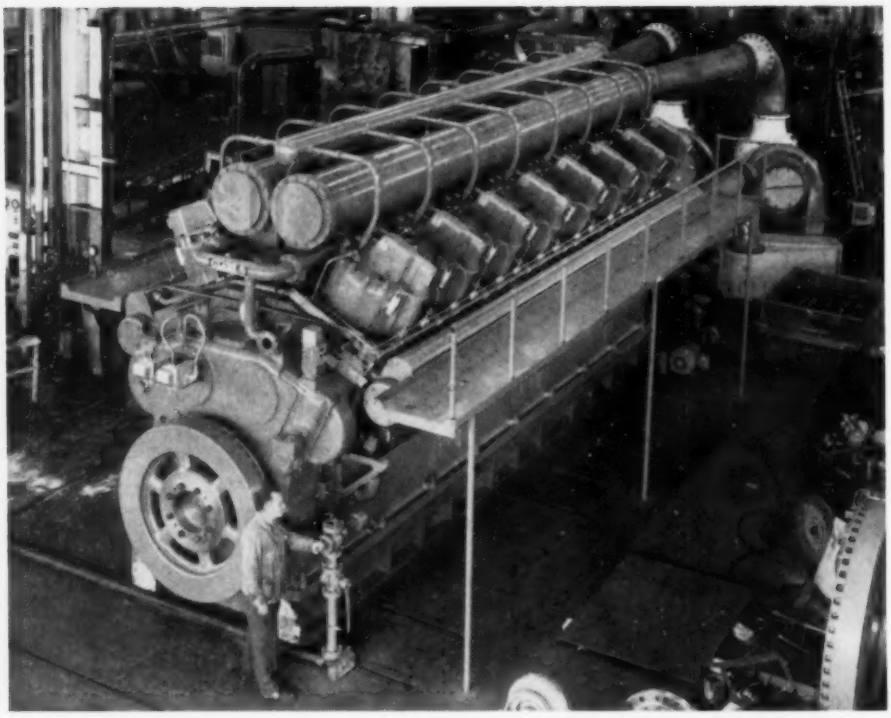
Steel



Large Gas Engines

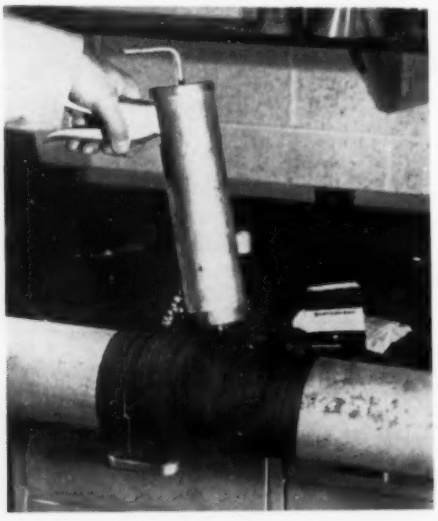
With compressor cylinders on one or both sides of the crankcase, a new high horsepower, V-type gas-engine-driven-compressor has been introduced by Clark Bros. Co. According to the manufacturer, the turbocharged, 2-cycle machine will be the world's largest gas-engine-driven compressor. Designed to provide low fuel consumption, the units are built in 12 and 16-power cylinder models rated at 4,000 and 5,500 bhp respectively.

Providing cylinder flexibility for a wide range of operating conditions, the use of compressor cylinders on one or both sides of the crankcase makes maximum use of available space. The TCV-16 can be fitted with as many as eight large cylinders to handle all types of pipe line requirements. Featuring a 15½-inch crankshaft, the engine operated over an unusually wide safe speed range—180 to 300 rpm. Since this 2-cycle design requires fewer parts than other type machines, there are less components subject to wear and replacement. The TVC unit is equipped with two turbochargers, one for each bank of power cylinders. The turbocharger along with external fin and tube scavenging air intercooler may be mounted on the engine or away from the engine, either inside or outside the building.

The cylinder block is a massive, heavily-ribbed casting of semi-steel to insure maximum rigidity and permanent alignment to the power cylinders. Power pistons are the two-piece oil cooled type.

(This item supplements Clark Bros. Co. data on Page 72 of the Pipe Line Catalog, Third Revision.)

For more data, circle **No. E6** on Readers' Service Card, last page this issue.



Epoxy Pipe Repair

Using thermosetting epoxy resins, a new method of pipe repair has been developed by Minnesota Mining and Manufacturing Co. It is designed to enable an average workman to repair a small hole in a six-inch pipe in 10 to 30 minutes, depending on working conditions. It can be used on all sizes of pipe in transmission and distribution. It can also be used for liquid pipe line repairs and for joining and patching plastic pipe. Scotchcast brand electrical No. 4 is the epoxy used for repairs. The resin is not affected by gasoline, fuel oil, crude oil or other hydrocarbons, and it resists most chemicals.

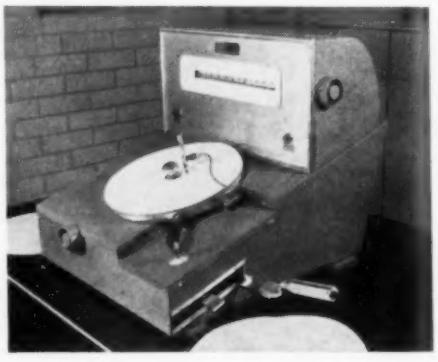
Briefly here's how it works. Thoroughly clean and dry area around hole or crack—usually eight inches on each side. Apply electrical tape No. 22—steel pressure bend may be needed if pipe pressure is too great. Wrap the screen-like tape, "spacer," around the pipe, covering an area six inches either side of hole. This serves as mold for resin. Next place injection fitting over the spacer tape. Wind No. 22 tape around the area already covered by the spacer. Then add a layer of cloth restricting tape over the vinyl electrical tape. This layer gives strength to hold resin in liquid state under pressure. Vent holes through both layers of tape are punctured. The epoxy is mixed, inserted in a container in a gun and resin is then administered through gun onto the repair section. Resin will harden in about 30 minutes and cure in less than two hours.

For more data, circle **No. E7** on Readers' Service Card, last page this issue.

Dewtector-Chart Averager

A dewtector for positive dew point readings and a chart averager has been developed by UGC Instruments Division of United Gas Corporation.

The dewtector has a self contained light source which permits dew points to be taken at night or under any adverse weather or enclosure conditions. The 16X magnification permits ready differentiation between hydrocarbon and water dew points and between water dew points and ice points.



The chart averager continuously averages temperature, gravity or pressure charts. One operator handles the entire job, without comptometers or adding machines. And it is accomplished in one operation. No special skill is required, only a short period of instruction and practice is needed.

For more data, circle **No. E8** on Readers' Service Card, last page this issue.

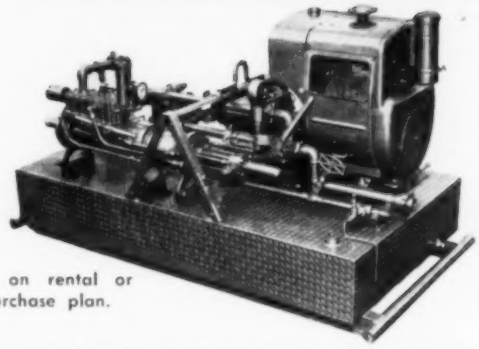
Mobile Pressure Test Unit

A mobile high pressure test unit for testing equipment up to 15,000 psi has been introduced by Consolidated American Services, Inc., Hawthorne, Calif.

The unit is self-contained and is fitted into a highly mobile four wheel drive

UDELL

PORTABLE HYDROSTATIC TESTING UNIT



Available on rental or lease-purchase plan.

Skid mounted and completely self contained, this unit delivers pressure to 20,000 psi. Operating components are mounted on the 200 gallon water tank. Variable test pressures provided by Udell Model "6B" two-stage, double-acting pump. Water pump delivers 250 GPM. Selected test pressure is maintained by engine throttle. Write for complete data and specifications.

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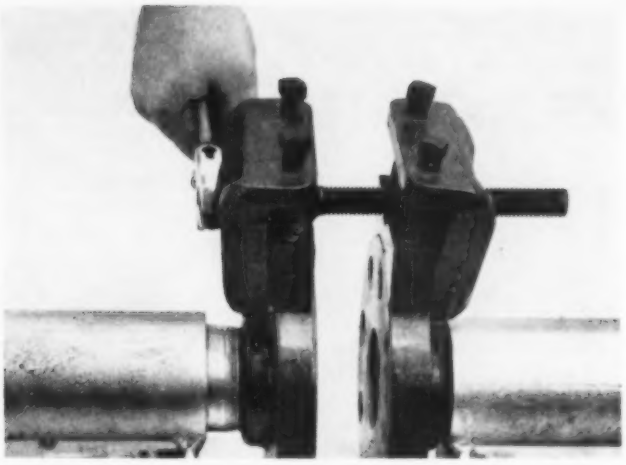

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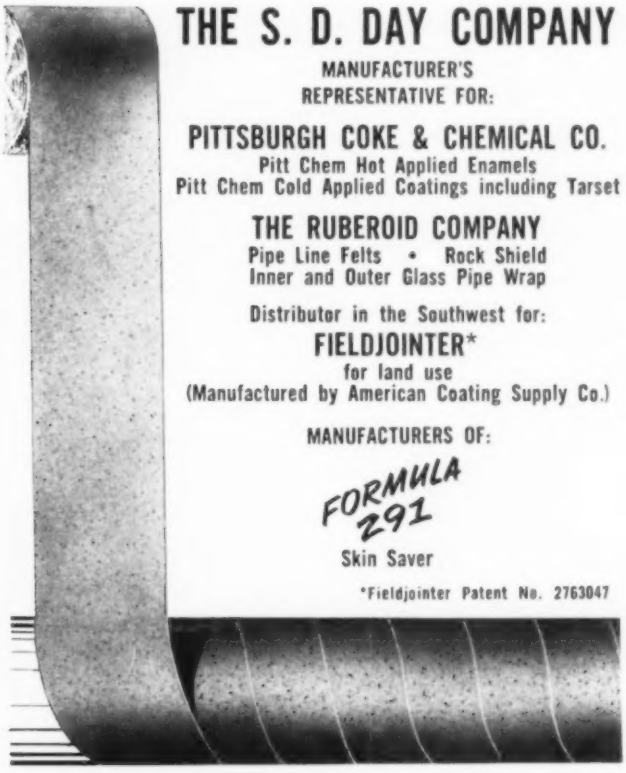

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•

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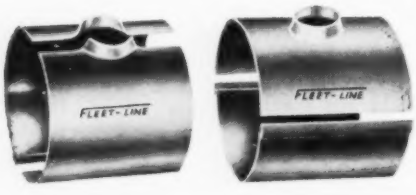
SADDLES: Conventional, and for pressure vessel heads. Nozzle sizes from ¼" to 24". Fleet-Line saddles weld neatly into place in much less time, and with much less welding rod.

Full encirclement saddles.



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truck capable of moving rapidly over rough terrain. Effluent gases are air filtered to a very fine degree and are perfectly cleaned through the use of a 10 micron wire mesh filter. Also they pass through a dehumidifier to assure maintenance at the desired dew point.

For more data, circle **No. E9** on Readers' Service Card, last page this issue.

Small Trencher

A self-propelled trencher in a small package has been introduced by Auburn Machine Works, Auburn, Neb. A single unit body constructed of steel plate, becomes a mounting fixture to support all other parts in perfect alignment. The four-wheel drive in both forward and reverse is powered by a hydraulic drive. The digging boom is lifted hydraulically through an arc of 186 degrees. Auburn has eliminated the need for a separate trailer or truck to haul the compact trencher. Transport wheels, which raise and lower hydraulically and a retractable draw bar, enables it to be towed by any vehicle to the job site.

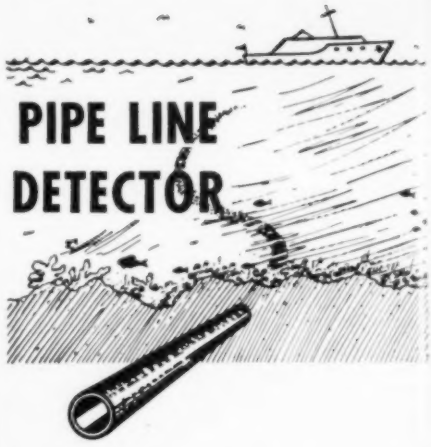
It is powered by 9 hp engine. It features two-way dirt disposal and non-clogging digging bits mounted on a specially designed digging chain of 24,000-pound tensile strength. Trenches may be cut 3 inches, 4½ inches and 6 inches wide and down to 5 feet deep.

For more data, circle **No. E10** on Readers' Service Card, last page this issue.

Write for Bulletin

PIPELINE VENTS AND MARKERS

FLEET-LINE CO.
P. O. BOX 276-K
SHREVEPORT
LOUISIANA



A *MARINE PIPE LINE DETECTOR* for river crossings, bays, marshes, and offshore—used to locate your pipe lines. This magnetic detector locates and determines the amount of overburden on your marine pipe—**Locates** them quickly, accurately, and economically.

MARINE GEOPHYSICAL SERVICES CORP.
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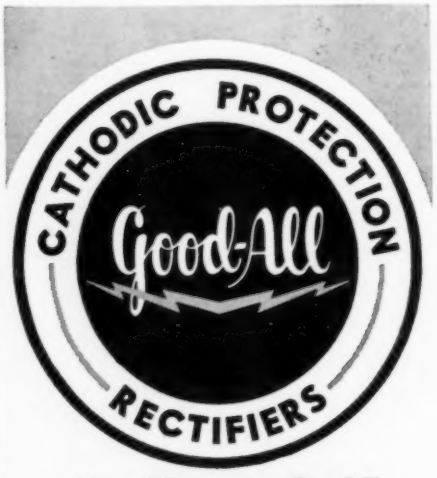

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SILICON RECTIFIERS
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GUARANTEED
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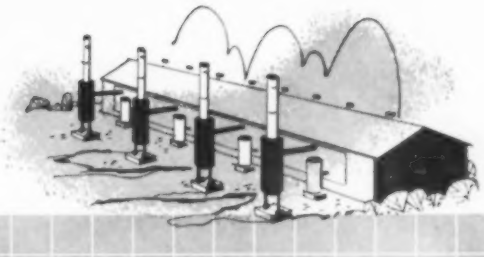
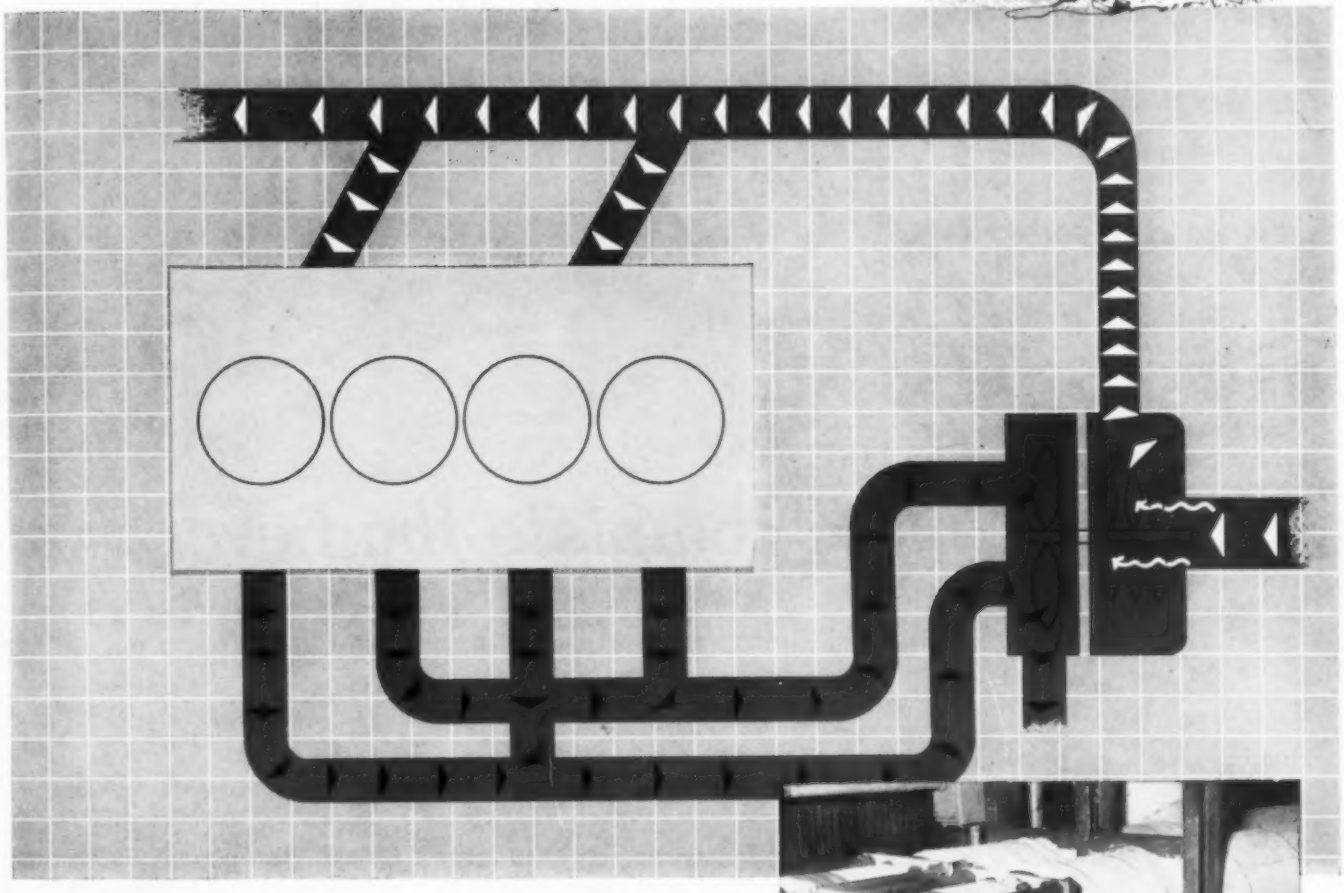
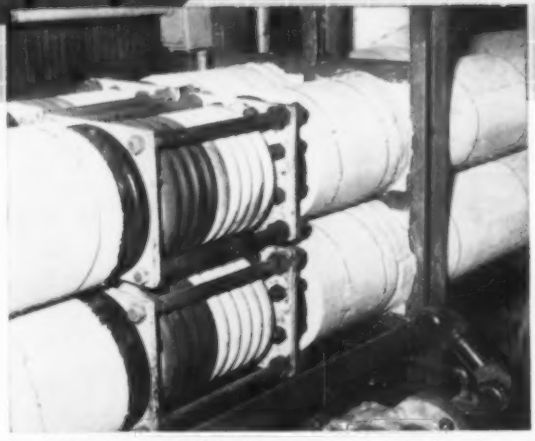




Here's a lively subject – *increasing gas pipeline capacity by turbocharging existing compressors in the field.* If you want the answers to the expansion problems that arise when the exhaust piping becomes an integral part of the operating loop, call on FLEXONICS engineers. They have the *specific* experience in this field that can mean actual dollar savings to you.

Write today for your free copy of this easy-to-read report. It tells you the dollars-and-cents facts that led an important pipeline company to a complete turbocharging program.



Special-design FLEXONICS Expansion Joints in the exhaust piping of a newly turbocharged compressor station.

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For more data on advertised products, use Readers' Service Cards, last page.

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These leading manufacturers, suppliers and service companies have filed complete or condensed catalog data in the current edition of the new PIPE LINE CATALOG. See their detailed information in the catalog when you are ready to buy.

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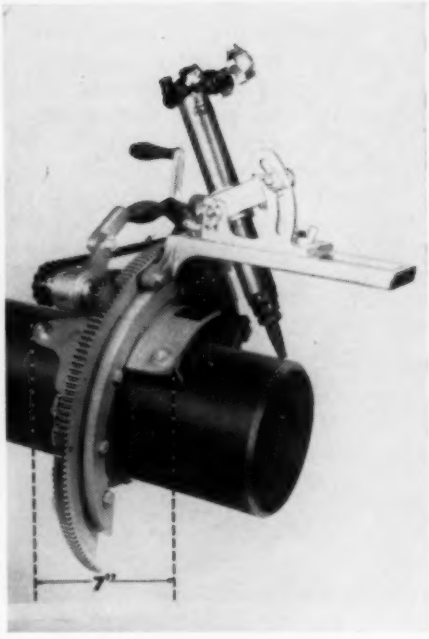


Beveling Machine

A shorter, balanced ring gear-saddle assembly, making it possible to cut on shorter segments of pipe, is the main feature of a new line of pipe beveling machines introduced by C. A. Mathey Machine Works, Inc.

The newly designed machine reduces storage; it is compact and has cut excessive weight to make it easier to handle. In larger models the weight factor becomes important.

For more data, circle **No. E11** on Readers' Service Card, last page this issue.

Literature

For more data on New Equipment or copies of Catalogs and Literature reviewed in this issue, use the Reader Service postcards just inside the back cover and facing the Advertisers' Index. Simply circle code numbers of items desired—sign and mail card.

Valve Lubrication

An automatic lubricator for lubricated plug valves is described in a new bulletin issued by the Rockwell Manufacturing Company. It contains illustrations and details on construction of the lubricator, tells how to install and operate it and gives information necessary for the device's adjustment.

The lubricator is an accessory for Rockwell-Nordstrom lubricated plug valves. It provides a continuous and regulated supply of lubricant, especially desirable for remote and other installations where hand lubrication might be difficult.

To get a copy, circle **No. E12** on Readers' Service Card, last page this issue.

Shovel-Cranes

Covering its 25-ton one-yard crawler mounted shovel crane, Thew Shovel Company has published a 12-page catalog. The two-color booklet gives details of consruction including Lorain's "joystick" controls, square-tubular-chord-boom, oil enclosed travel mechanism and many other features as well as photographs of the machine in action.

The Lorain 50 is a versatile machine easy to convert to shovel, crane, hoe, clamshell, or dragline.

To get a copy, circle **No. E13** on Readers' Service Card, last page this issue.

Consultant's Role

A 40-page booklet describes the consultant's role in business management. Published by Commonwealth Services Inc., it highlights the growing complexity of management functions and reviews one consulting firm's approach to management problems.

The book points out that both large and small firms can use consultants temporarily to gain the competitive advantages of more comprehensive staff work.

To get a copy, circle **No. E14** on Readers' Service Card, last page this issue.

Engine Rundown

Twenty-seven International diesel and carbureted engines—in four, six and eight-cylinder versions—are detailed in a new, three-color booklet issued by International Harvester Company's Construction Equipment Division.

Units are available from stripped engines to complete power units, 10 of which are diesel, with two of four-cylinder design and eight of six-cylinder category. Horsepower ratings range from 16.4 to 385; weights are from 279 to 6,045 pounds.

To get a copy, circle **No. E15** on Readers' Service Card, last page this issue.

Timing Belts

An eight-page bulletin on "5 Simple Steps to the Selection of Timing Belt Drives," has been issued by T. D. Wood's Sons Company. It includes five sets of curves for drive-width selection.

The method of computation is illustrated by a sample problem: namely to connect a 15 hp, 1,750 rpm, squirrel cage motor, of NEMA design B and normal torque, to a turret lathe to operate at 875 rpm.

To get a copy, circle **No. E16** on Readers' Service Card, last page this issue.

Industrial Equipment

A new 24-page full-color catalog-type brochure showing the entire new industrial equipment line of Massey-Ferguson has been published. Actual photographs, cutaway drawings, operating information and specifications material on the many items in the industrial line are covered in the brochure.

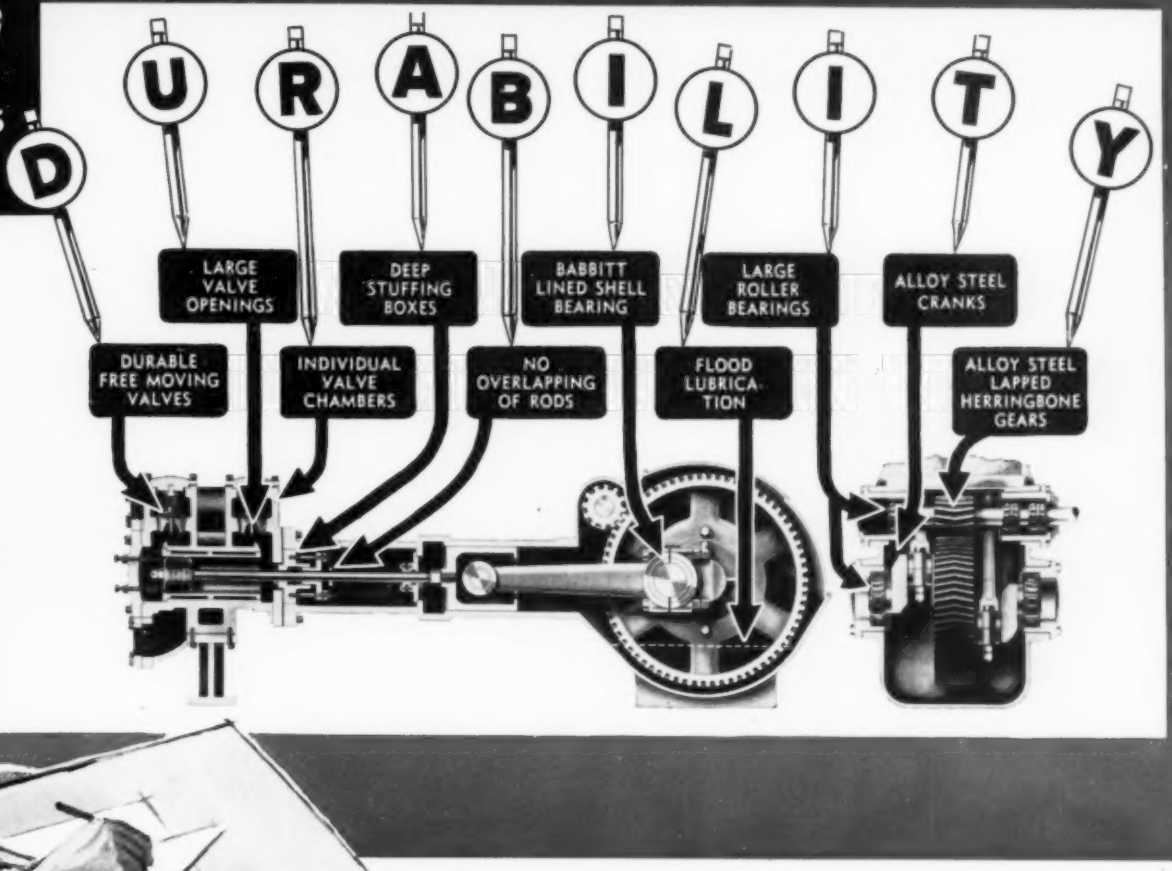
To get a copy, circle **No. E17** on Readers' Service Card, last page this issue.

Insulated Motors

A four-page bulletin describes the epoxy-insulated form-wound motors of the Elliot Company. The epoxy insulation protects against salt water, acids, alkalis, solvents, cutting oils, carbon-black, abrasives, etc. They have high thermal stability and withstand both heat and cold.

To get a copy, circle **No. E18** on Readers' Service Card, last page this issue.

ASO PUMPS



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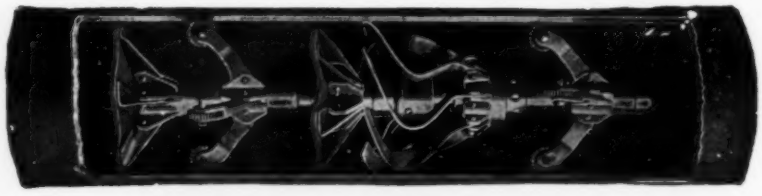

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Partly compressed guide arms and knives are held tight but flexible against pipe walls by pressure of individual springs. Guide arms keep scraper in line, eliminating undue driver wear and prevents cocking. Flexibility permits Go-Devil to round bends.

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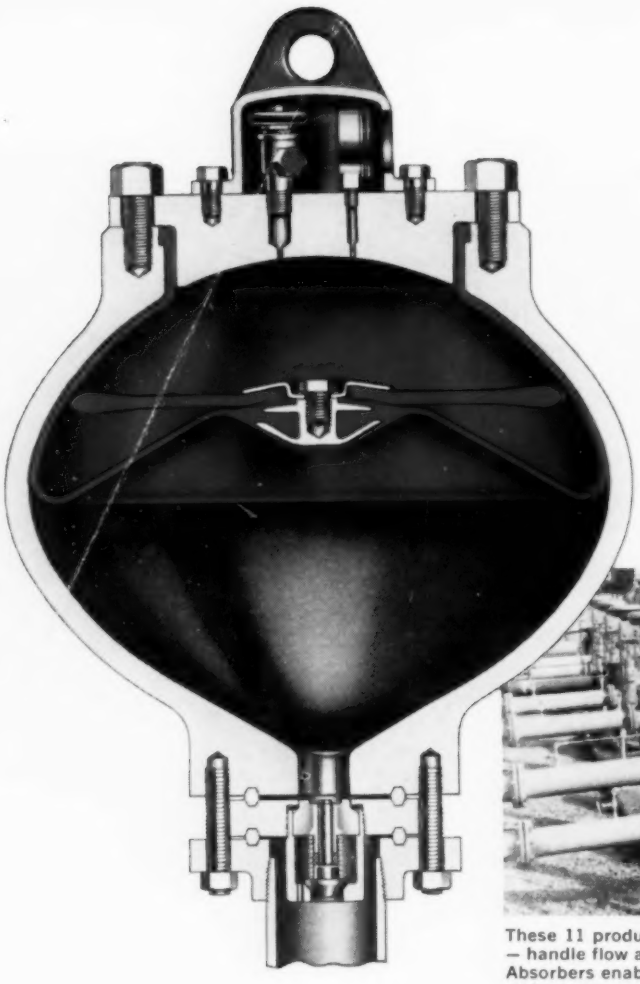

prolongs life of pipelines, fittings and pumps... saves downtime... cuts maintenance costs!

These 11 product transfer lines — some over 1,000 feet long — handle flow at the rate of 1,600 gpm each, yet Hydril Surge Absorbers enable them to be closed in a fraction of a second without over-pressuring lines, fittings or metering equipment.

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